ZORKI-4 CLA

APRIL 5 2020

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1. Introduction

And warning

In this document I describe how I have Cleaned, Lubricated and Adjusted (CLA'd) a 1961 Zorki-4 rangefinder camera.

I have had no training as a camera repair technician. Most probably, some - or all - of my techniques and procedures will be frowned upon by a proper repair technician. Notwithstanding that, the many pictures I have taken and figures I have drawn during the dismantling and reassembly of the camera may be useful to a wide community. In my favor I can report that I started with a camera with lagging and sometimes stuck shutter curtains and that I ended up with a fully functional camera.

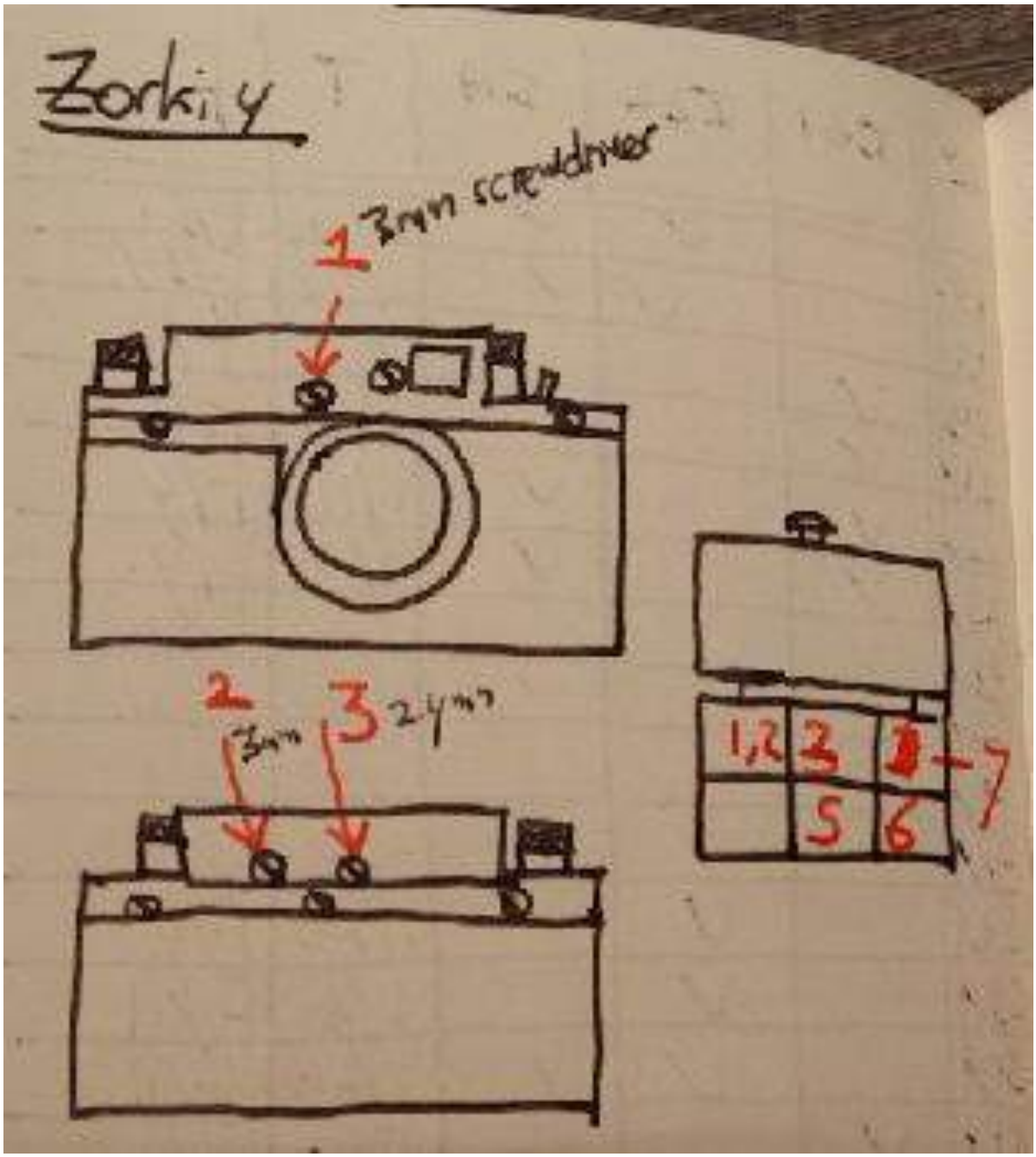
For dismantling and reassembling my Zorki-4, I have made use of information I have found by searching the internet. My main sources of information have been a post by Mike Eckman: https://www.mikeeckman.com/2015/11/zorki-4-v2-1961/ and a thread on the rangefinder forum: https://www.rangefinderforum.com/forums/showthread.php?t=33914 (look here for the same information in one PDF file: https://fotoguru.nl/wp-content/uploads/2019/05/Zorki-4K-CLA-How-to.pdf). Furthermore I have used http://rick_oleson.tripod.com/index-58.html and the book "All you need to know about the design and repair of Russian cameras" by Isaak S. Maizenberg.

My advice is to use these documents as well and combine the information and pictures found there and here to make your job easier. As always in disassembling a camera, make a lot of pictures of every disassembly step and make drawings/sketches as well.

Drawings will help in separating head from side issues; they will remove the clutter that is unavoidably present in photographs.

I have experienced that this camera is very serviceable and does not need special tools. I have only needed a set of precision screwdrivers and a pair of needle-pointed pliers.

I also recommend to use pill boxes with compartments to store the screws that you will take out. Make a drawing of these boxes. Then also make sketches of the camera and indicate the screws that you take out, giving them the appropriate numbering, see the figure below.



Use drawings to highlight details and to identify screw positions and temporary storage.

2. The Camera

The Zorki-4 is a 35mm, coupled rangefinder camera for interchangeable lenses. It uses the M39 Leica Thread Mount (LTM). It has a horizontal focal plane cloth shutter and shutter speeds ranging from 1 to 1/1000 seconds and B. It has a diopter adjustment at the viewfinder. It has no light meter and therefore does not need a battery. The first two digits of the serial number indicate the production year.

1961 Zorki-4 with Industar-22, retractable, 50mm f/3.5 lens.

The take-up spool in the camera can be removed, so if you buy a Zorki-4 through the internet, make sure that the spool is included. You can buy a separate spool afterwards, but they don't come cheap and it takes some time before it will arrive through the mail. Unfortunately, I do know what I'm talking about here.

1965 (see serial number) export - ('made in USSR') Zorki-4 with take-up spool.

3. History

The history of the Zorki-4 and his predecessors are closely related to those of the FED cameras, another Former Soviet Union (FSU) line of cameras.

FED cameras have their origin in an orphanage in Kharkov in the Ukraine.

The First World War, the Russian Revolution in 1917 and the following civil war that lasted till 1923 had left the country with a lot of orphaned children.

Felix Edmundovich Dzerzhinsky, F.E.D. (1877-1926) was appointed by Lenin in 1917 to set up the *All-Russian Extraordinary Commission for Combating Counter-Revolution and Sabotage* or '*Cheka*'. The *Cheka* was predecessor of the NKVD that later split into the KGB (now FSB) and MVD. Dzerzhinsky took the rehabilitation of orphaned children as one of the responsibilities of the *Cheka*, the secret police.

In 1926, Dzerzhinsky died of a heart attack and in 1927 the Ukrainian police opened the F.E. Dezerzhinsky Labour Commune in his honor. The FED commune started with 150 boy and girl orphans in the age from 13 to 17 years, who spend their time doing labor and receiving education.

The commune started making furniture and later moved to producing electric drills.

To make the Soviet Union more self-sufficient and becoming less dependent on import, it was decided in 1932 to produce Leica camera copies. By 1934, complete copies of the Leica II, including the lenses, were produced at the FED Commune.

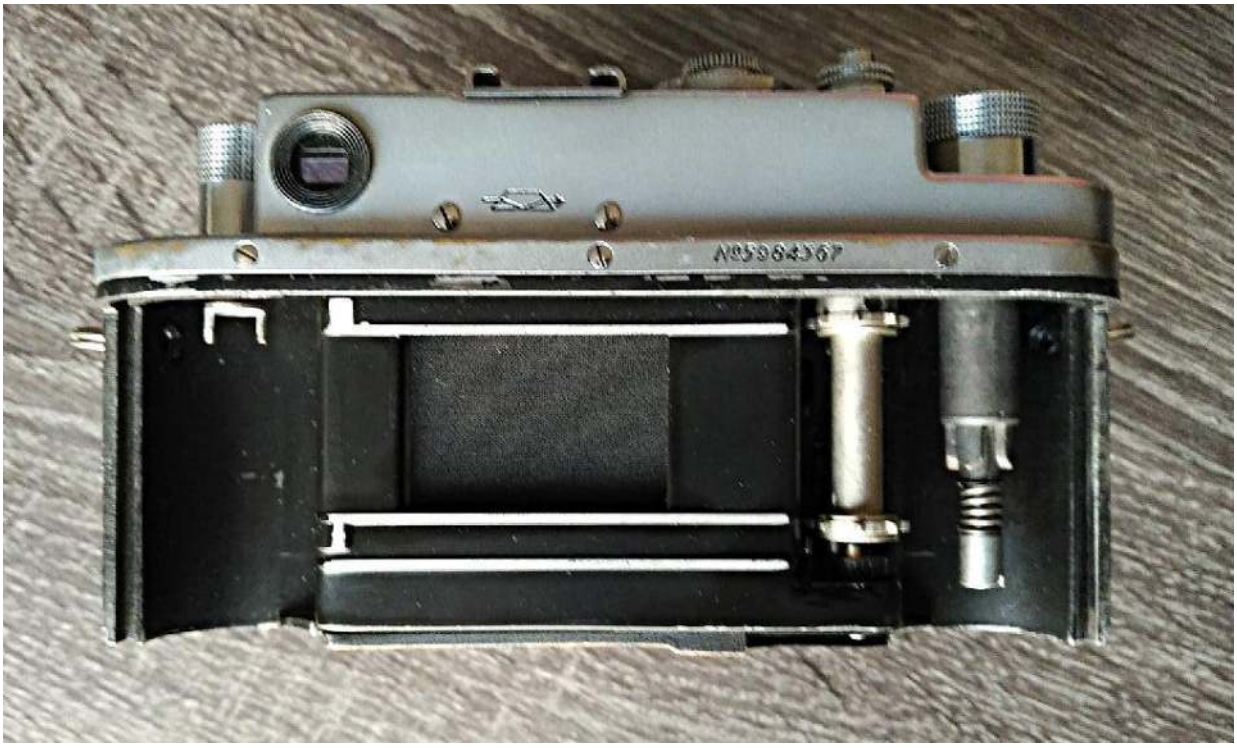
When the Germans invaded the Soviet Union in 1941, the production facilities, as far as possible, were brought to safety beyond the Urals and the rest was destroyed. After the Second World War, in 1947, production of Zorki cameras started in the Krasnogorskii Mekhanicheskii Zavod (KMZ) factory near Moscow. These Zorki cameras were copies of FED cameras (that were copies of Leica cameras). The first ones had a combined FED/Zorki engraving on the camera body.

FED returned to the Ukraine, being back in full production by 1949, and new FED and Zorki camera designs started to divert although sharing the same origin.

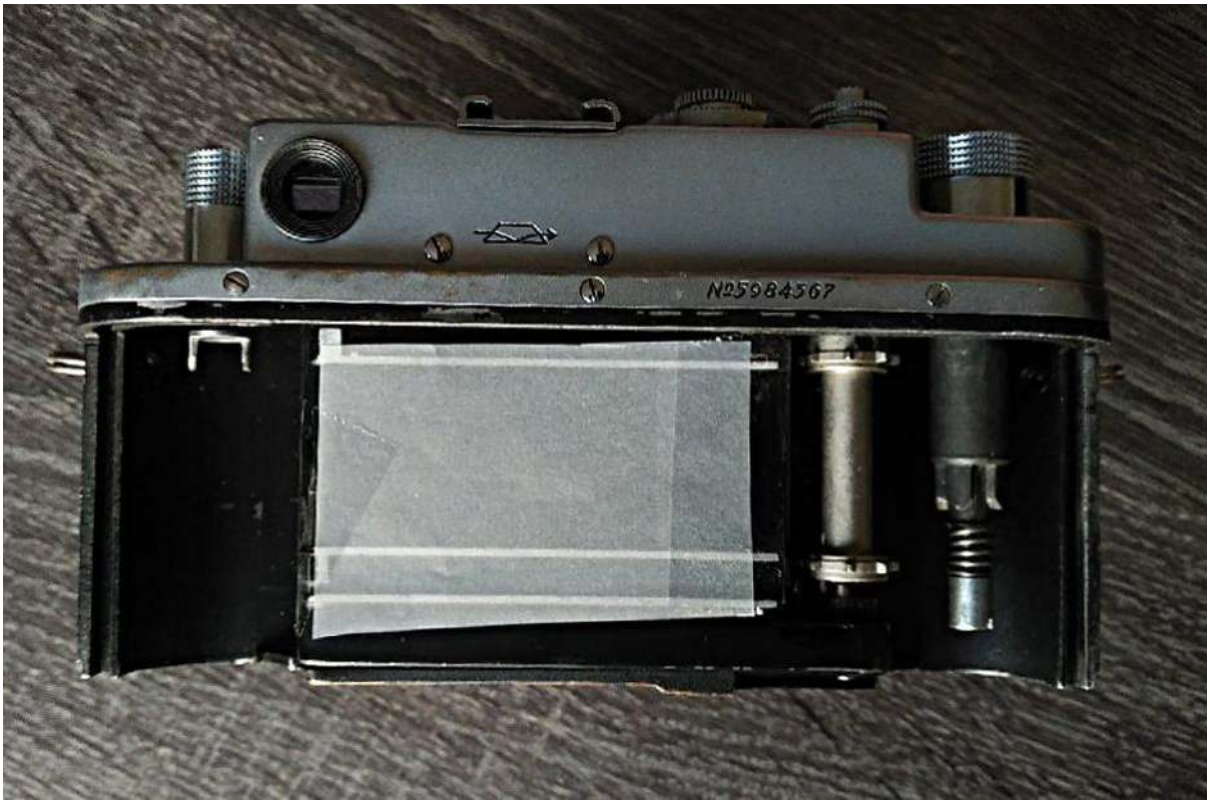
4. Before Dismantling the Camera

The camera we have at hand here looks very good. It has no dents, scratches or missing parts. Also, the optics are clean. The rangefinder is accurate in finding the distance.

I use a simple way to test this:
I open up the camera (watch for the take-up spool falling out). Then, I attach a piece of tracing paper (that I buy at an art supply store) over the shutter curtain using two pieces of adhesive tape on the metal rim that guides the film, see figure below. This paper, attached on the focal plane will act as a ground glass. I cock the shutter and select B(ulb) for the shutter time, using the largest aperture. Then I use the range finder to focus on a subject (making the two images in the viewfinder coincide) and press and hold the shutter. The shutter curtain is now open and an image (upside down and reversed) will be visible on the makeshift ground glass, see the figure below. I check the image to see if it is in focus. Eventually I use a magnifying glass.



Camera with cover taken off. The focus needs to be in the plane where the film will be.



Tracing paper is attached to the ‘film-plane’.

With the aperture wide open, the shutter speed on B and the shutter pressed, the image is visible on the tracing paper and can be checked for focus.

By the way, the pictures above have been taken using a 1959 MIR camera. The MIR is a 'low-budget' version of the Zorki-4 for the internal market, lacking the low speeds (1/60, 1/15, 1/8, ¼, ½ and 1 seconds). *MIR* translates from Russian to English into *peace*. *Zorki* translates into *sharp-sighted*.
The reason for using the export Zorki and the MIR for showing the take-up spool and the focusing check, respectively, is that at the writing of this report the actual Zorki-4 is loaded with film.

Finally, before actually dismantling the Zorki-4, I need to say something about the typical Zorki-4 smell. I have noticed that all my FSU cameras recently purchased (2 Zorki-4s, a MIR and a FED-3) come with a strong army-surplus-store smell. If you have ever been in an army-surplus-store you will recognize this musky smell. At first, I did not find it too offending, although a bit strong, but then I realized what it is: It is skin oil and sweat of previous users that has been absorbed into the camera's black covering over the years. I definitely want to get rid of that!

To get rid of this smell, I dissolve baking soda in household vinegar and use a lint-free cloth to rub this cleaning fluid into the covering. I repeat this until the cloth comes off clean. Just to be sure, I give the cover a final rub with 70% denatured alcohol (the stuff you can buy at any drugstore) and I'm done.

5. Removing the Top

The reason for dismantling the camera is that the shutter curtains show a visible lag and sometimes are stuck. The effect of lagging shutter curtains is shown in the figure below. Also, the lower shutter speeds (1/60 seconds and below) are unreliable. The idea is that I will dismantle the camera to get to the parts that need cleaning, lubrication and adjustment (CLA). For that I will use the references mentioned in the introduction as a guideline. I will only go as deep as is necessary. So, this report is in no way a comprehensive Zorki-4 repair or maintenance guide.

Effect of lagging shutter curtains, noticeable in the uneven exposure on the left and – to a lesser extent – on the right of the frame. Picture taken with a FED-3 camera, having a shutter nearly identical to the one of the Zorki-4.

So, let's start by reassembling the camera. As a first step we will unscrew the lens.

As a first step we'll unscrew the lens and store it in a safe place.

Zorki-4 without lens.

To get inside, we start by removing the shutter speed selector. For that we will loosen the two screws, but will not remove them, see the picture below. The screw positions are indicated by red arrows. I have used a 1.2mm screwdriver. After that we'll loosen the synchro ring, using a 1.2mm screwdriver as well. The ring stays in place.

Loosen (don't remove) the screws in the shutter speed dial to get it off. One screw is on the left, just outside view. The positions are indicated by red arrows. Also loosen (don't remove) the synchro ring screw (on 5 o' clock position). The ring stays in place.

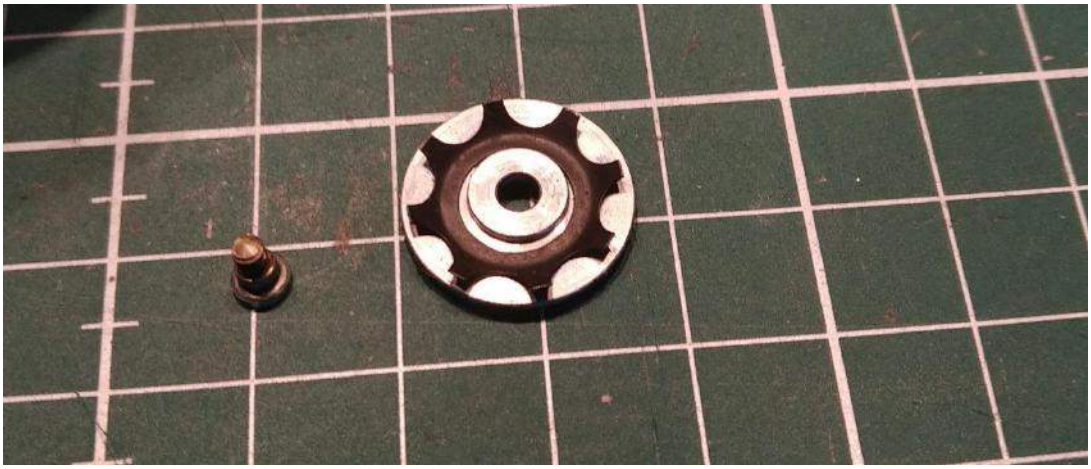
The top of the camera now looks like the picture shown here.

Zorki-4 with shutter speed dial removed.

Next, we will remove the top of the winder knob, shown on the right in the figure above. A 4mm screwdriver will do the job, see the picture below.

Removing the Zorki-4 winder knob top plate.

Be aware that at the bottom side you'll find a star-shaped washer. Take note of the position (top-bottom). Lay it aside on a safe place.



Bottom side of the winder knob top plate. Note the position of the star-shaped washer, the points of the star are directed to the camera body (when in place).

Next, the winder knob itself is removed by turning it counter clockwise, see figure.

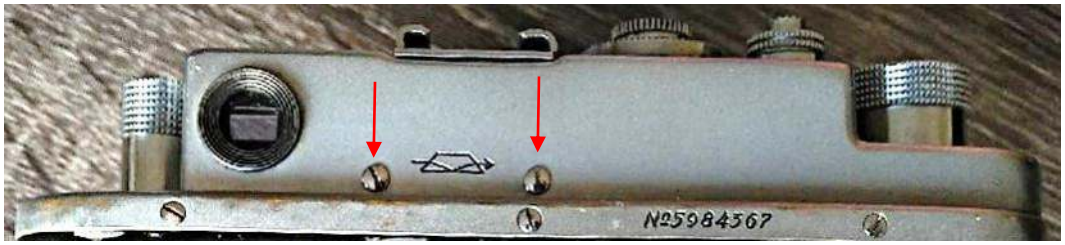
Removing the winder knob by turning it counter clockwise.

After removing the top of the camera we will replace the winder knob for testing purposes. For the moment, we will lay it aside.

Next, we will remove the two screws above and below the rewind shaft, that are visible in the above figure on the right. For that we will use a 2.4mm screwdriver.
Then, we will remove one screw from the front of the camera. That will be the crew between the rangefinder window and the engraved '-4', see the picture below. A 3mm screwdriver will do the job. The screw to the left of the (large) viewfinder window will be left in place. This screw gives access to a hole to stick in a screwdriver for tuning the rangefinder.

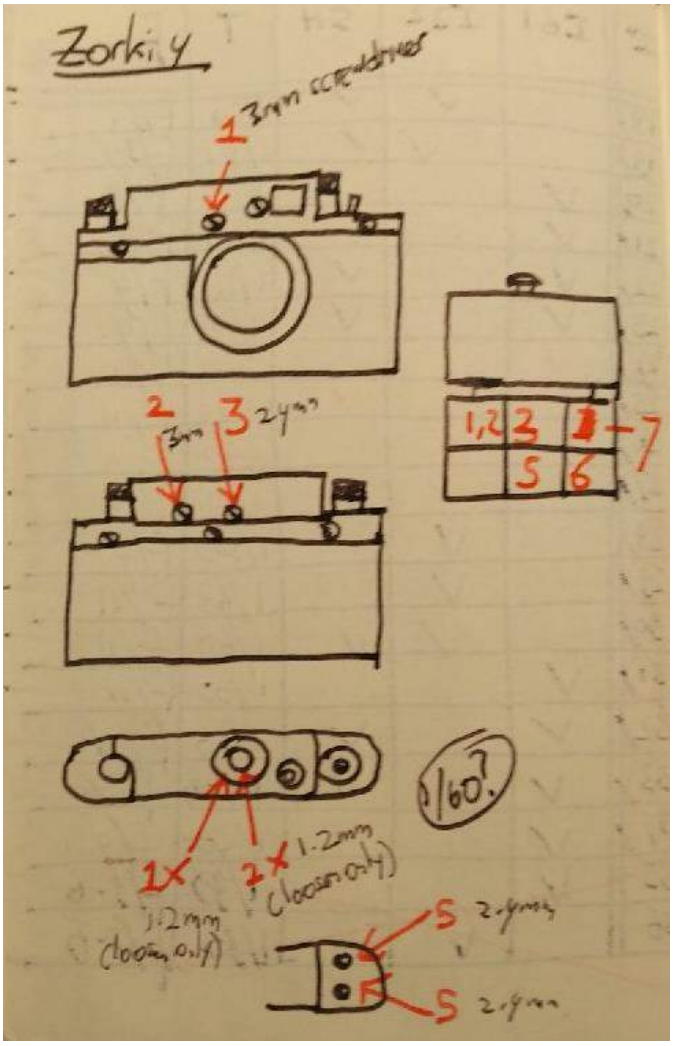
The screw indicated with the red arrow needs to be removed from the front.

From the back, we will remove the two screws at both sides of the KMZ logo, see the figure. For the screw on the left I have used a 3mm screwdriver. For the one on the right, a 2.4mm screwdriver.



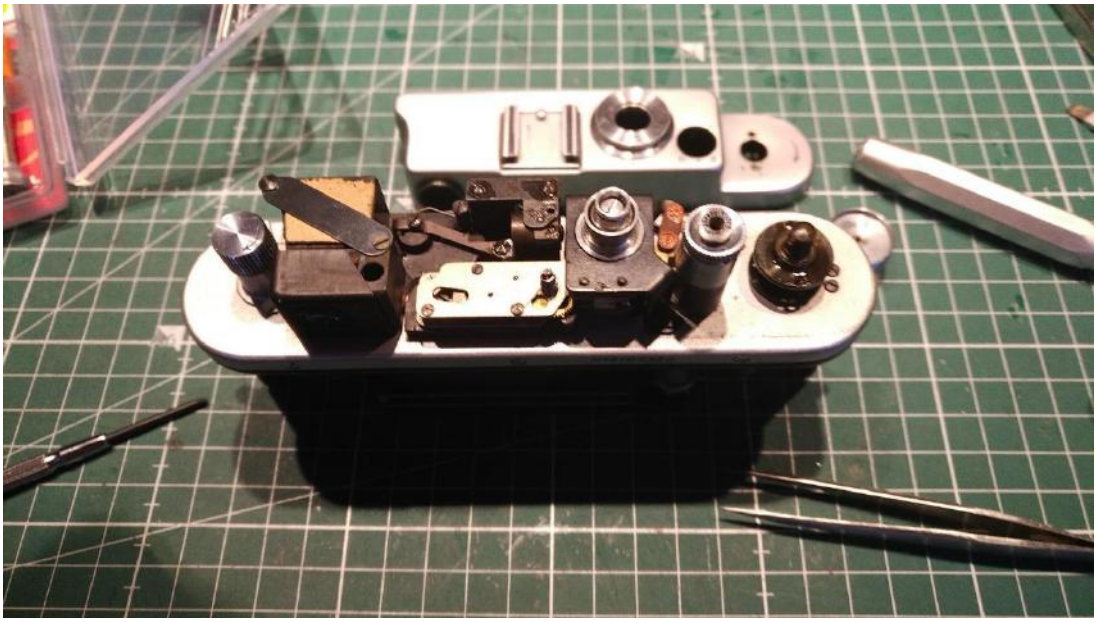
The screws indicated with the red arrows need to be removed from the back.

This is a good moment to stress again the importance of making drawings or at least make notes of where the different screws are stored. The picture below shows some of the notes I have made in the first part of disassembling the Zorki-4. On the right of the picture is a drawing of the pill box that I have used for temporary storage of the screws.



My notes on screws, positions and temporary storage.

Now, we can finally lift off the top.



Zorki-4 with top removed. Note that the synchro ring is loosened but still in place.

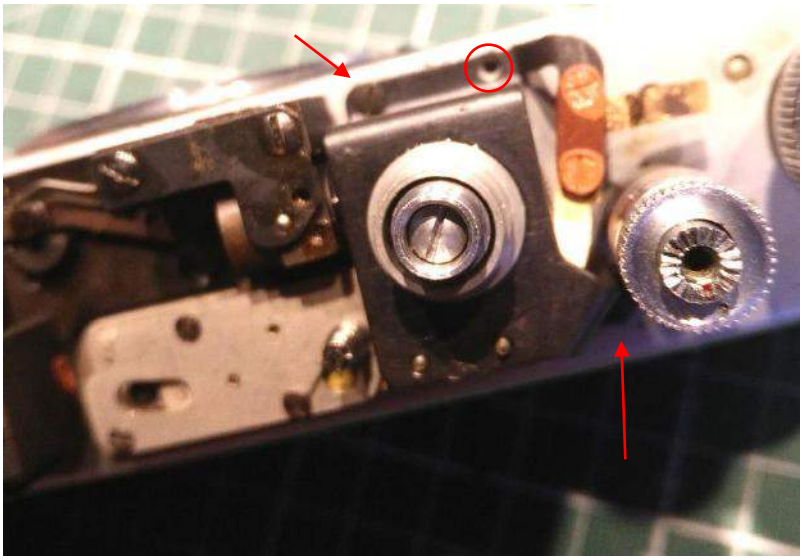
6. Removing the Flash-Synch-Switch

Looking down on the top of the camera, we see a black metal construction around the shutter speed selection shaft. This is the flash-synchronization-switch that we will remove first. Underneath this black metal construction, in the lower-left-corner, we see a copper colored construction. This is the slow-speed-mechanism that accounts for the shutter speeds 1/60, 1/15, 1/8, ¼, ½ and 1 seconds. Without this mechanism, that we will remove after we have removed the flash-synchronization-switch, the Zorki-4 is basically a MIR camera (but not so in practice, the mechanism is needed).

Before we will proceed, we will first look at the construction with the flash-synchronization-switch and the slow-speed-mechanism from different angles.

The flash-synchronization-switch is secured with two screws, but there seems to be room for three screws. The ‘missing’ screw seems to be intentional though and is reported in the references given in the introduction.

The slow-speed-mechanism is secured with two screws. One of those is positioned underneath a large gear. Furthermore, we see that spacers are being used. We will get to that in more detail later on.



Top view of the flash-synchronization-switch. The red arrows indicate the screws securing it. The circle shows a 'missing' screw.

The slow-speed-mechanism underneath the flash-synchronization-switch. Note the screw underneath the large gear (red arrow) and the use of spacers (green arrow).

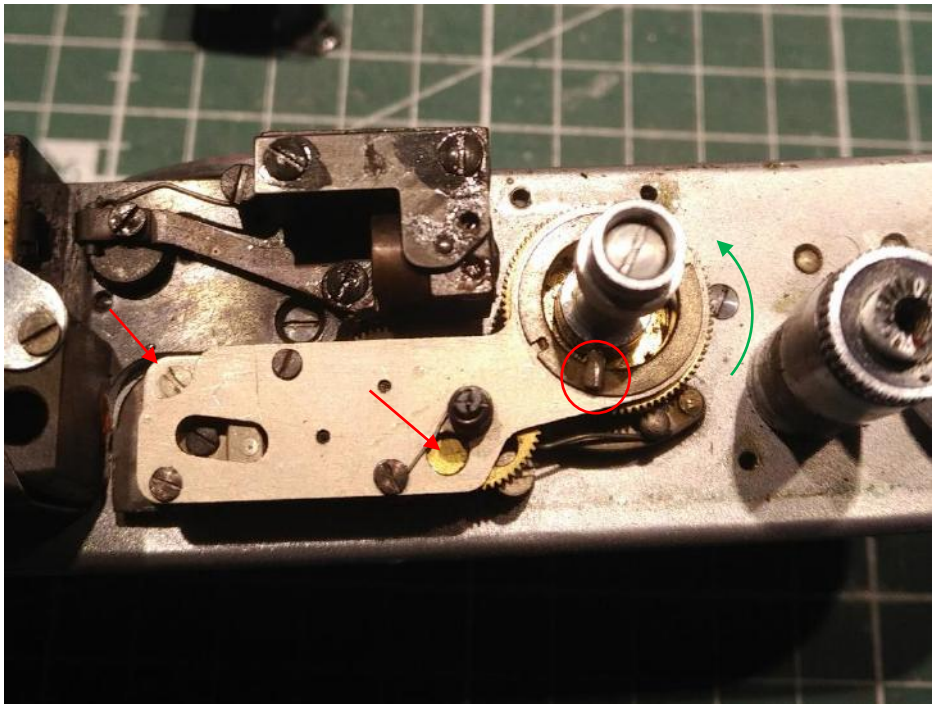
Front view showing the flash-synchronization-switch over the slow-speed-mechanism.

We will now take out the flash-synchronization-switch by unscrewing the two screws securing it. We use a 2.4mm screwdriver for that. Since I don't intend to use the flash synchronization switch, I simply lay it aside as is (i.e. I don't move parts).

Top view and bottom view of the flash-synchronization-switch.

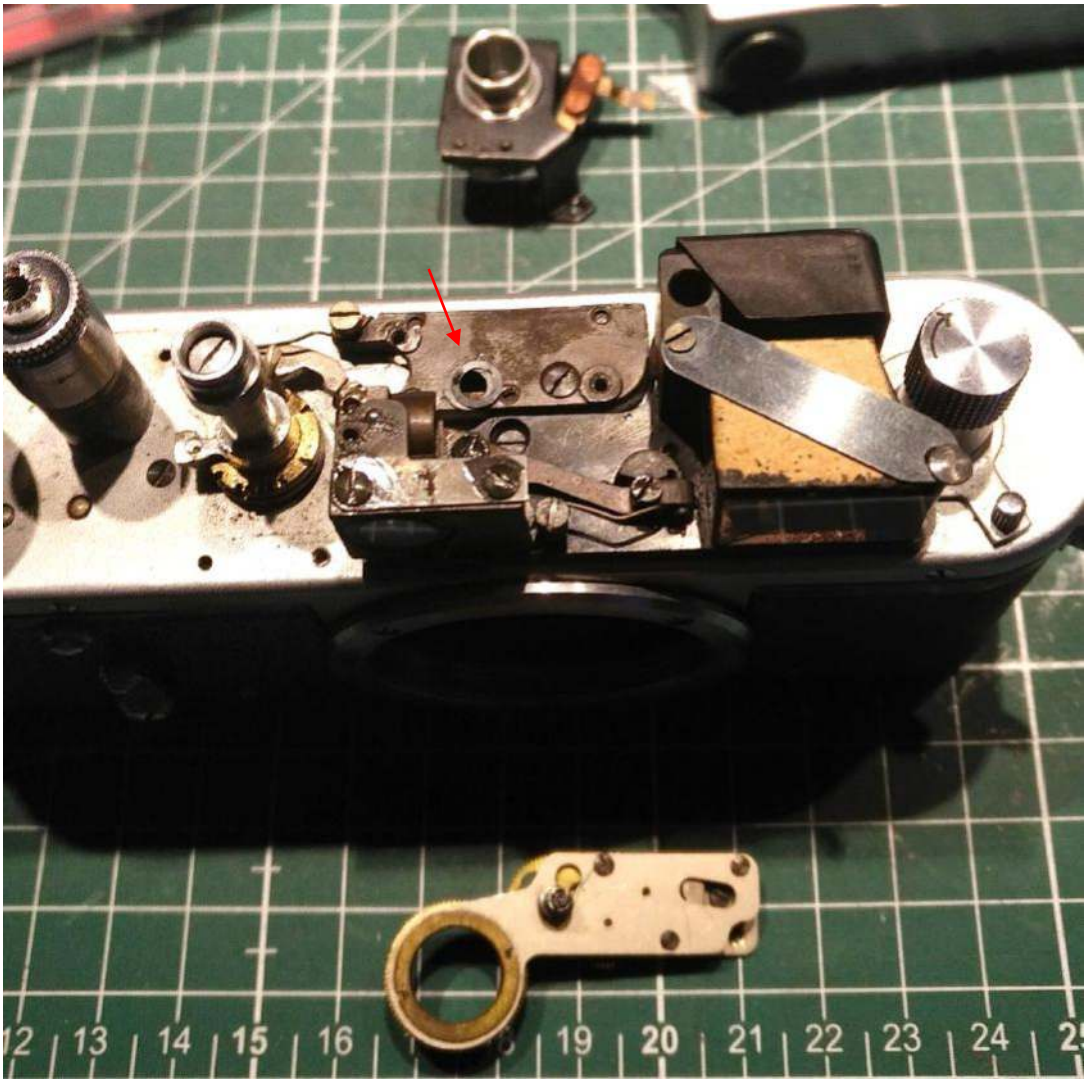
7. Removing, Cleaning and Lubricating the Slow-Speed-Mechanism

The top of the camera now looks as shown in the photograph underneath.
To take off the slow-speed-mechanism, we need to unscrew two screws, the positions of which are indicated by red arrows. One screw (top left corner) is easily accessible. To get access to the other one (bottom right corner), we need to rotate the gear that is over it to expose a hole through which we can stick a screwdriver, see the earlier shown picture (bottom page 19). To rotate this gear, we use our fingers to turn the large gear that is around the shutter speed selection shaft counter clock wise. Once we have access to the second screw, we unscrew it, but leave it in the slow-speed-mechanism. Then we lift off the mechanism, carefully wriggling it around the L-shaped hook. This L-shaped hook is indicated with the red circle in the photograph. You will hear the mechanism unwind. Don't panic, it's supposed to do so.



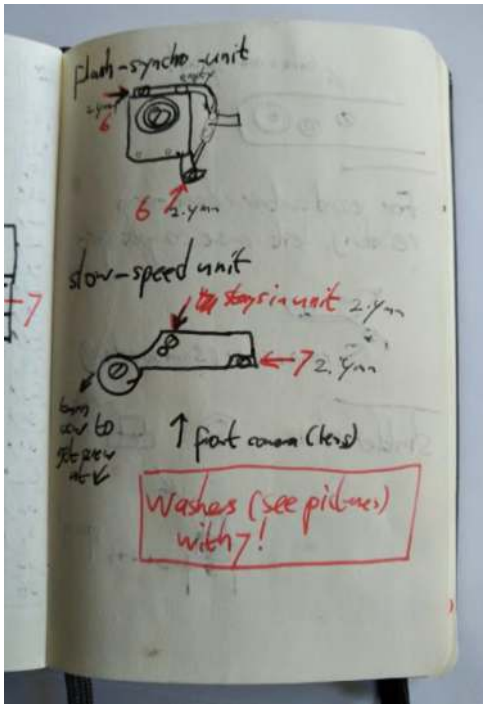
Screw positions (red arrows) and L-shaped hook (in red circle). Turn the gear as indicated (green arrow) to get access to the lower screw.

The camera with the slow-speed-mechanism taken off is shown below. Note the different washers still present, used to level the mechanism. Some of them have been just floating freely in grease. They have not contributed to the leveling of the mechanism. Therefore, they will not be put back when we reassemble the camera. I guess it must have been an off day for the factory worker. Notwithstanding that, so far, my impression is that this is a very well-designed camera.



The slow-speed-mechanism is taken off. Note that we have turned the camera around. Also note some washers remaining on the camera house (red arrow). Not all of the washers are functional.

Having come this far, I think it helps to show the sketches and notes I have made during the disassembly.

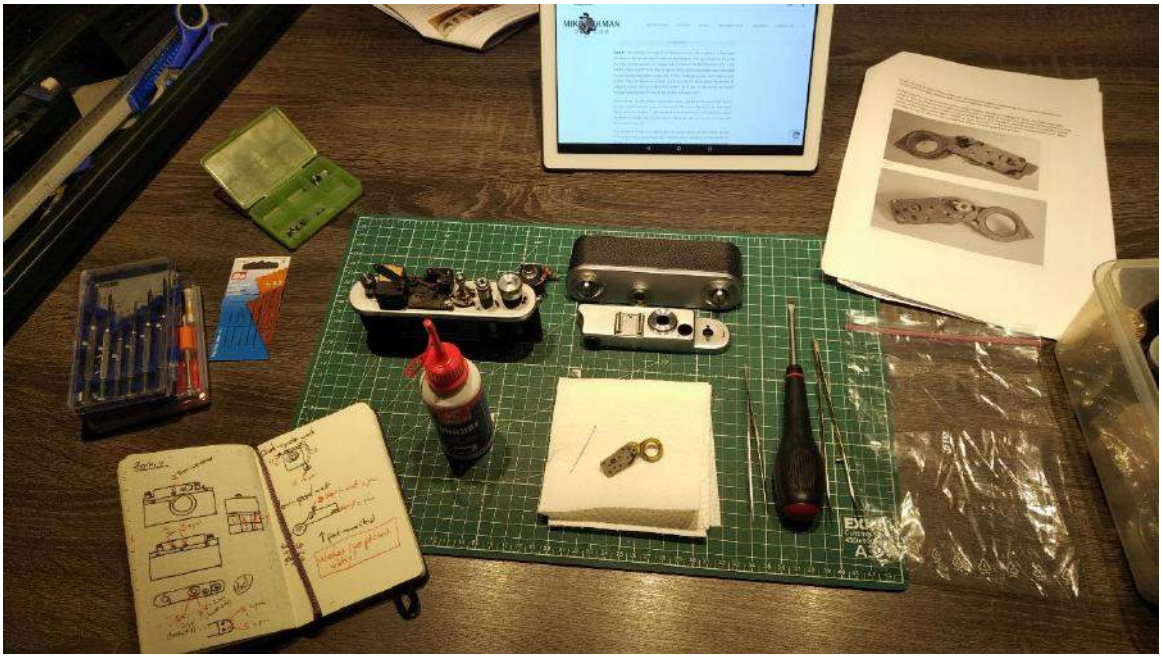


My notes on the disassembly of the flash-synch-switch and the slow-speed-mechanism. I stored the washers with screw nr. 7 in the comparted pill box.

To degrease it, I have put the slow-speed mechanism in lighter fluid. A 35mm film container is just right for this job, see the picture. Don't leave it in overnight though since I noticed that the plastic softens a bit. I have let it in for about half an hour.

Degreasing the slow-speed-mechanism in lighter fluid.

After the degreasing, we let the mechanism dry and are ready for lubrication, see the figure.



Degreased slow-speed-mechanism, ready for lubrication. Note that I have all references mentioned in the Introduction strategically lying around.

For the lubrication, that must be done sparingly, I use sewing machine oil and a needle to apply it, see the figure.

Lubricating, using sewing machine oil and a needle. The lid of a 35mm film container forms a handy oil reservoir.

For identifying the lubrication points, I have followed the instructions found in the thread by ‘wolves3012’ from the rangefinders-forum (see introduction). These points are indicated in the figure below.

Lubrication points for the slow-speed-mechanism (red arrows).

After lubrication, use the pin on the O-shaped gear (middle photograph above) to turn this gear about three times clockwise and release it. Repeat this a few times and see that the mechanism runs well, rewinds completely and comes to a halt at the same place every time.

When everything is satisfactory, put the mechanism in a (zip-lock) plastic bag for protection and lay it aside.

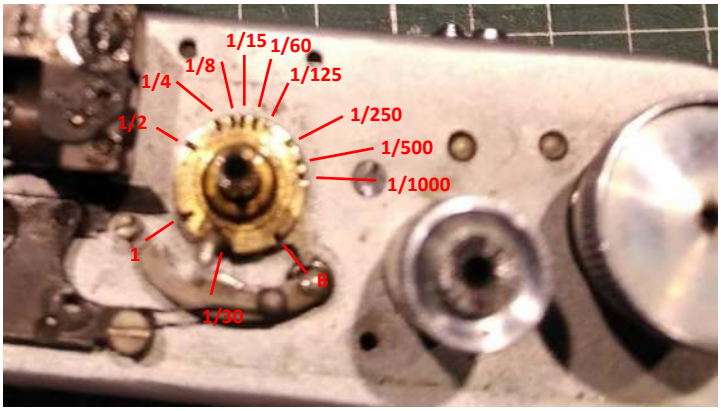
Store the lubricated low-speed-mechanism in a (zip-lock) plastic bag and lay aside. Drink a lot of coffee.

8. Lubricating the Shutter Speed Selector and Second Curtain Release Arm

Next, we will remove the shutter speed selector by unscrewing the screw on top. Be careful, since there is a spring underneath.

Remove the shutter speed selector and take care with the spring underneath the screw (red arrow).

After lubricating the shaft, the selector can be replaced. Before we do this, we'll first take a good look at the different speed selector notches in the copper colored disk.



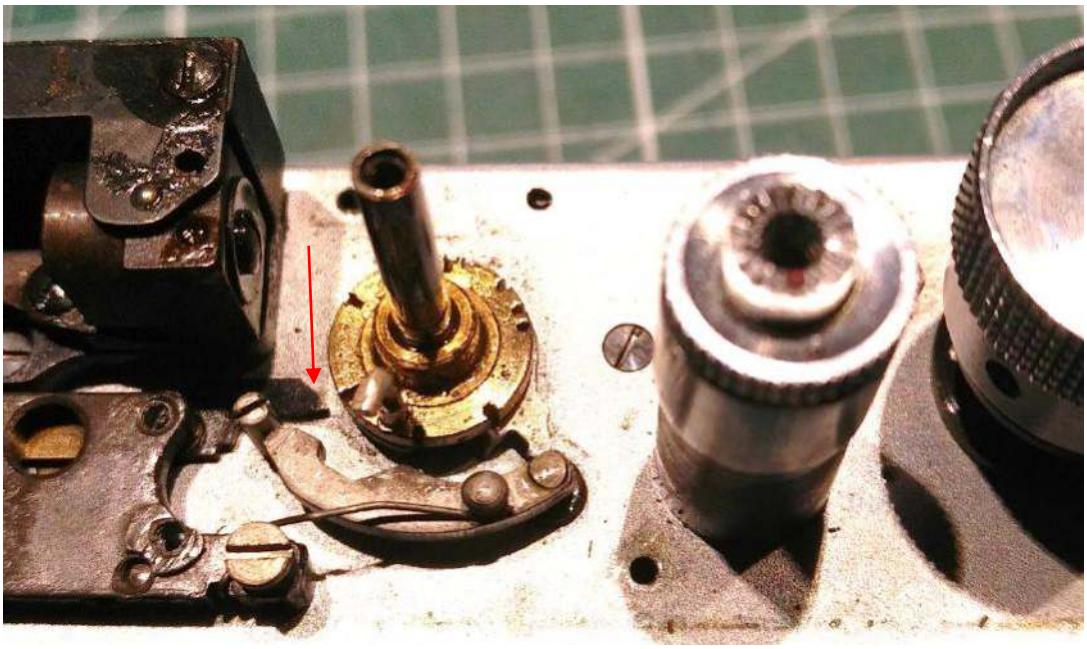
Zorki-4 speed selector notches and corresponding shutter times.

The notches for 1/60, 1/15, 1/8, ¼, ½ and 1 seconds are shallower than the ones for 1/1000, 1/500, 1/250, 1/125, 1/30 seconds and B. The shallower notches are used in combination with the slow-speed-mechanism (although 1/60 second does not).

When the shutter is fired, the first curtain starts to travel and after a while (set by the selection of the shutter speed) it hits a trigger that releases the second shutter curtain. This is how it works for the fast shutter speeds. In setting the lower shutter speeds, you'll wind the slow-speed-mechanism. You'll wind it more if you set for a slower shutter speed. Now, when the trigger is hit by the first curtain, the winded slow-speed-mechanism acts as a timer and holds the release of the second shutter curtain.

The 1/30 second setting is different and closely related to B. In this setting, the first curtain first travels the whole film exposure area distance before the second curtain is released. This makes this setting fit for flash photography, where the actual exposure time is not set by a moving curtain slit, but by the actual time of the flash.

The release of the second curtain is triggered by the black sliding lever indicated by the red arrow in the figure below. For the fast speeds, this lever will be pulled inwards. For the slow speeds it waits for the slow-speed-mechanism to push it inwards.

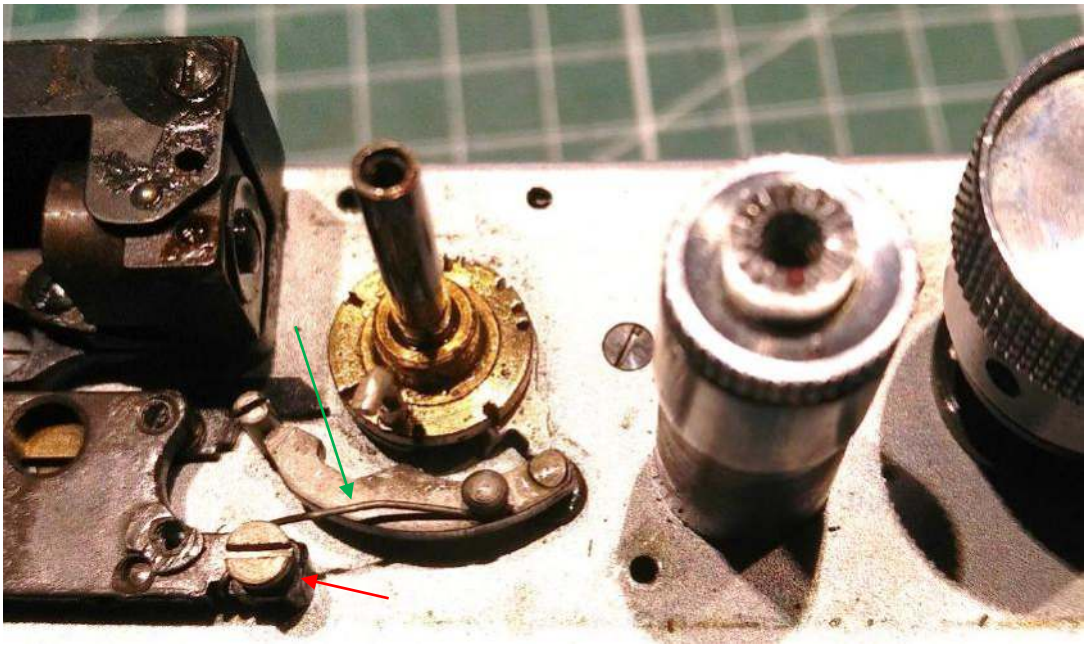


Black sliding lever (red arrow) triggering the release of the second curtain.

With the speed selector being put back in place and the winder knob being replaced (don't bother about the top plate), we can cock the shutter, select a speed and fire. When we do so, the second curtain will be stuck. Upon pushing the black lever with a screwdriver, we can release the second curtain.

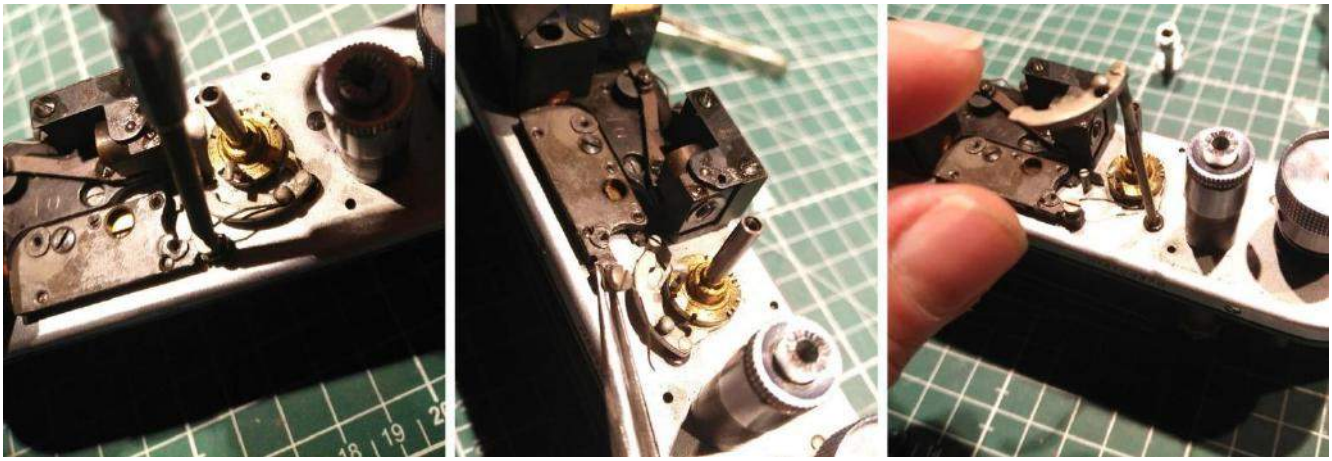
The actual release of the second curtain is performed by the second curtain release arm. The top of that device we see in the picture above, just below the black sliding lever that was indicated by the red arrow.

To remove this arm, in order to clean and lubricate it, we will first need to unhook the spring, see picture below (green arrow).



Spring, holding the second curtain release arm indicated with the green arrow. The red arrow indicates where the spring is connected to the body.

I found the unhooking of the spring quite cumbersome and decided for removing the spring altogether, loosening the screw indicated with the red arrow. A 3mm screwdriver was fit for this job, see the pictures below.

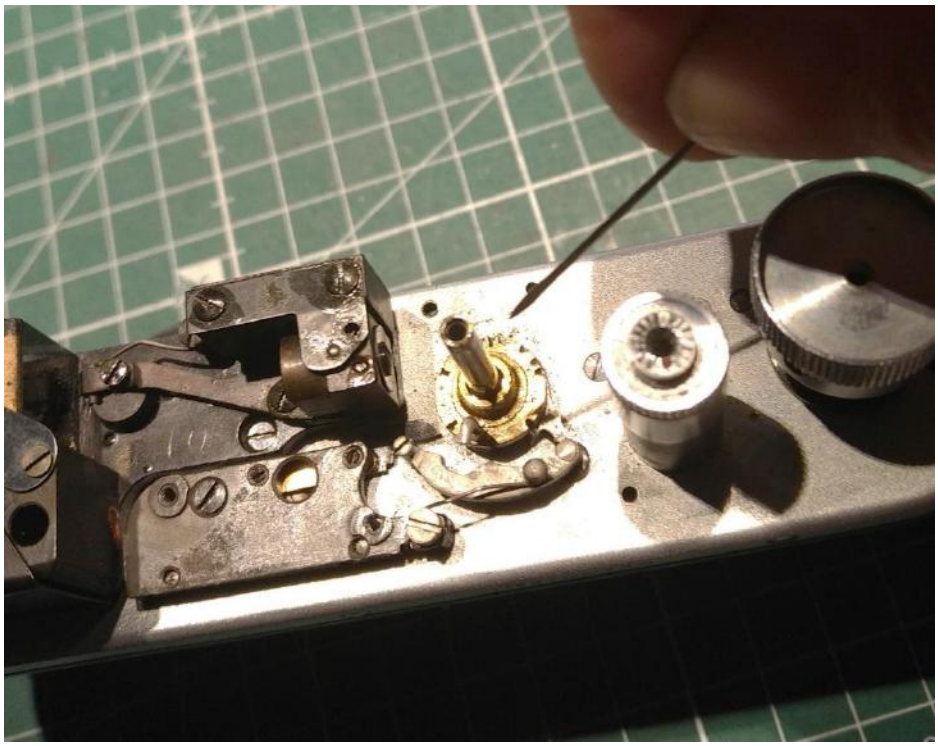


Remove the retaining spring by unscrewing it (left, middle). After that the second curtain release arm can be lifted out (right).

Finally, we will clean the arm, lubricate it with thin oil and place it back. After that we'll replace the retaining spring.

Clean and lubricate the second curtain release arm with thin oil before replacing it.

Next, we will lubricate the shaft of the speed selector itself and finally replace the speed selector. While lubricating the shaft, also some oil needs to be applied, sparingly, underneath the selector top plate.



Lubricating the shutter speed selector shaft.

Most of the references I have used, advice at this point to clean the optics of the viewfinder and rangefinder. I choose to postpone this to a later moment. There is more cleaning and lubricating to do and most probably I'll be touching the glass parts with my greasy fingers. I choose to do the cleaning of the optics at the moment of reassembly.

9. Cleaning and Lubricating the Shutter-Rewind Mechanism

We start the disassembly of the shutter-rewind mechanism by loosening the screw shown in the figure below. For that we use a 1.2mm screwdriver. Hold the shutter button while doing this, since there is a spring underneath!

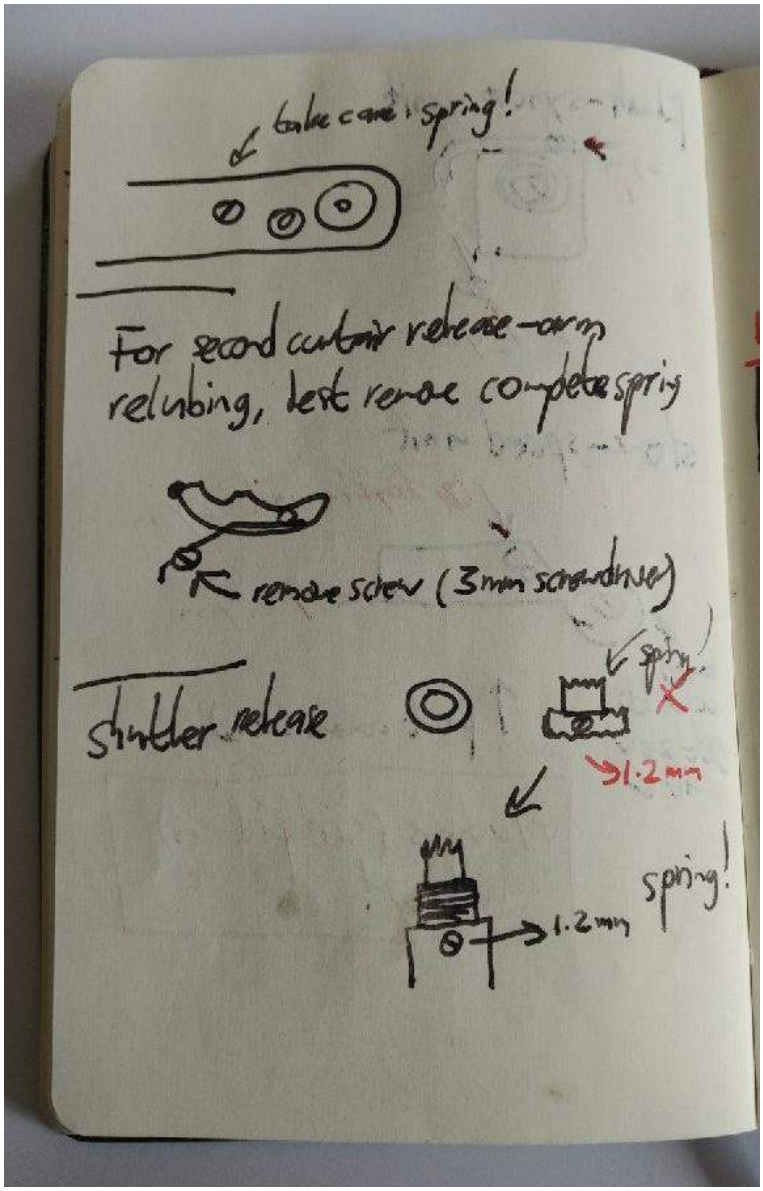
Remove this screw to start disassembling the shutter-rewind mechanism.

We can now take out the shutter-rewind collar, shutter button, spring and shutter rod, see picture below.

Shutter-rewind collar, shutter button, spring and shutter rod taken out. By removing the screw (red arrow) a second collar can be taken out.

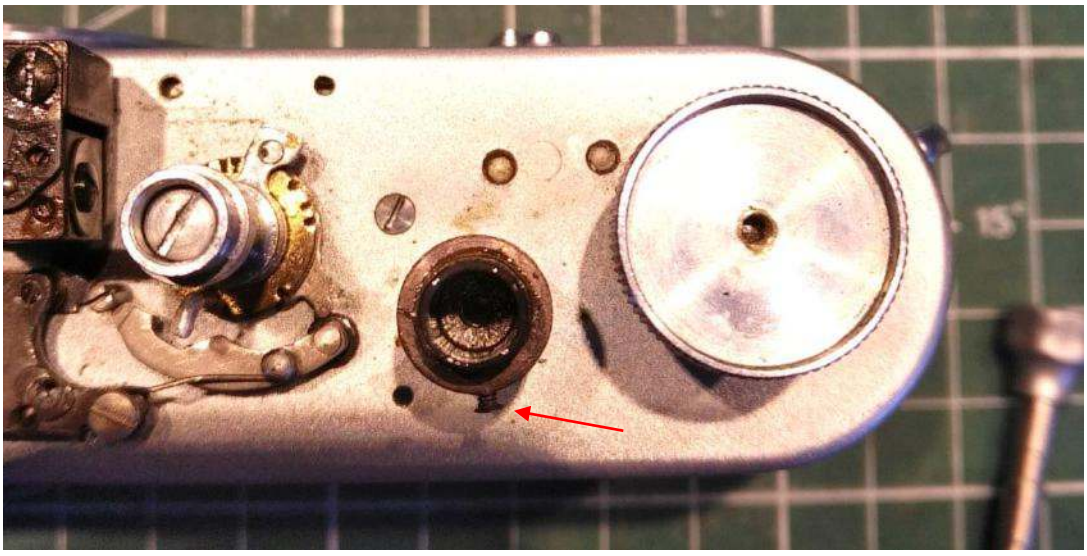
A second collar can be taken out by loosening the screw indicated in the picture above (red arrow).

At this point I want to show my notes again. I want to stress the importance of making notes and drawings/sketches, next to taking photographs, during the whole disassembly process. I understand that this is a practice that has been used by watch repair technicians in the pre-digital photography era. I think that this practice has lost nothing of its importance, despite modern digital photography.



My notes on the disassembly of the shutter speed selector, second curtain release arm and shutter-rewind mechanism.

The picture below also indicates the screw to be loosened to take out the second collar (red arrow). Be careful, a second spring is underneath! A 1.2mm screwdriver will do the job.



Loosening this screw will release a second collar. A spring is underneath!

The parts taken out are shown in the picture below.

Disassembled shutter-rewind mechanism. Note that the screws are loosened, not removed.

One additional collar with spring has come out. A second one did not come out, but this is not considered to be a big deal.

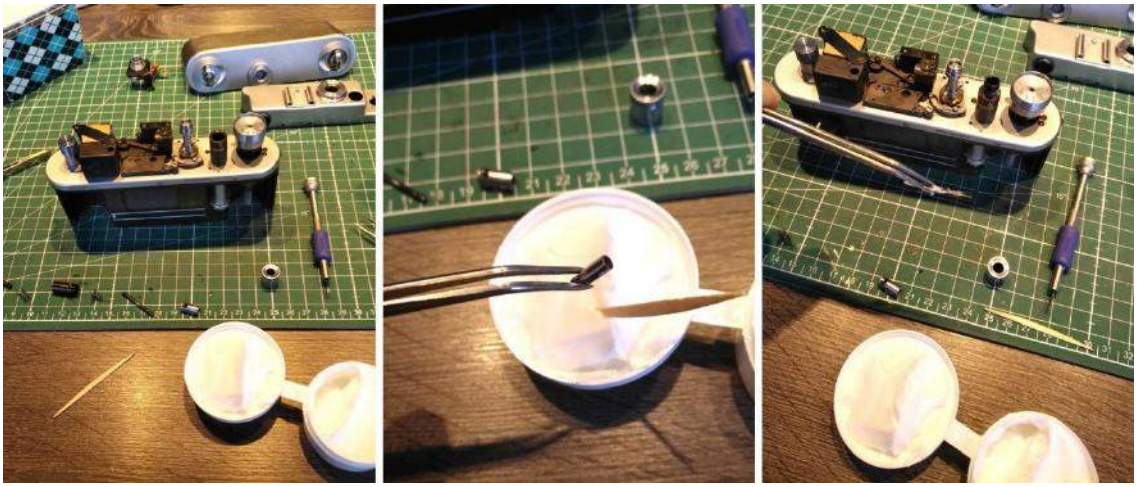
Next, we will degrease the inside, using q tips soaked in lighter fluid, see the picture below. This cleaning will also take care of the collar left behind.

Cleaning the shutter-rewind mechanism shaft.

Also, the parts that came out are degreased/cleaned.

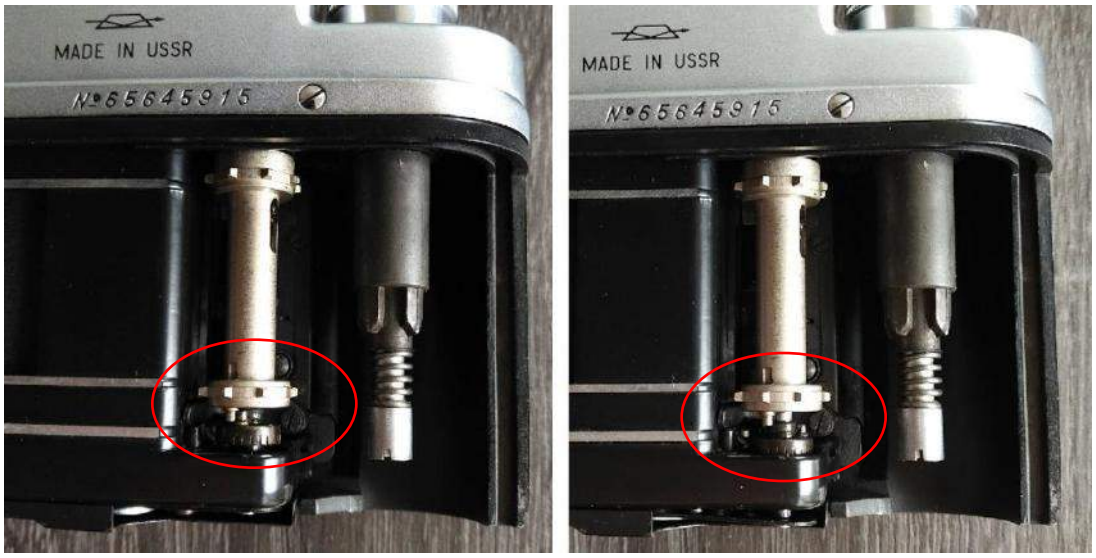
Cleaning the shutter-rewind mechanism parts.

Finally, we will lubricate the parts with silicone grease and reassemble the mechanism.



Lubricating the shutter-rewind mechanism parts with silicone grease before reassembly.

In the reassembly take care that the parts are reassembled in the same position that they were taken out. The shutter release rod needs to be installed with the narrowed part at the top, for example.
Make sure that the shutter-rewind mechanism works properly after reassembly. When the collar is turned counter clockwise, the film transport engages. When the collar is turned clockwise, the film transport is disengaged. This can be checked by inspecting the bottom of the film sprocket, see pictures below.

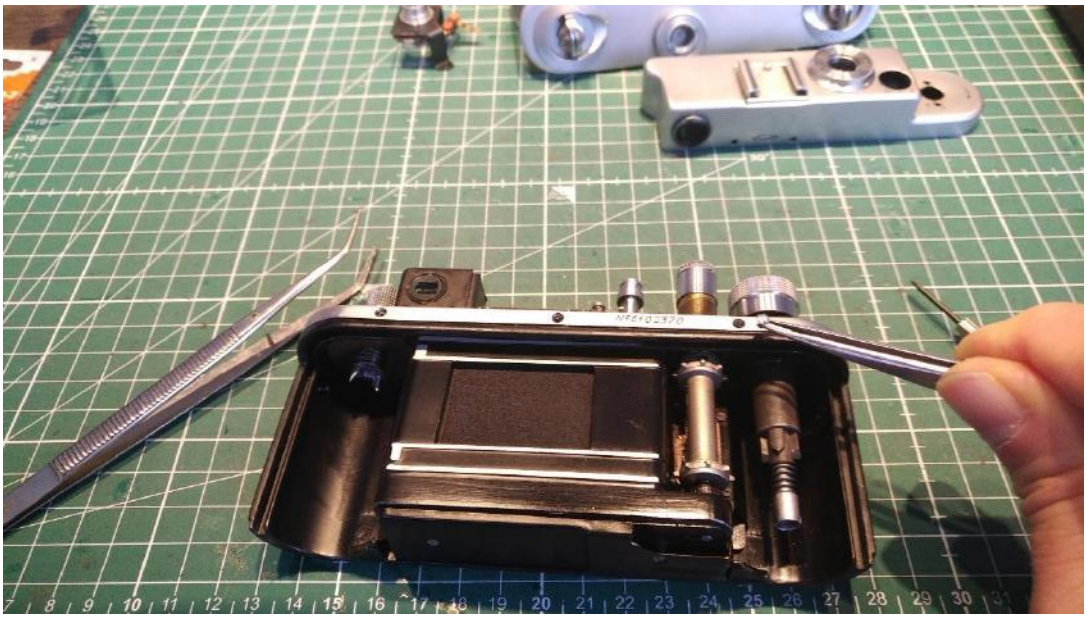


Left: sprocket engaged. Right sprocket disengaged. Notice the distance from the black wheel.

10. Removing the Shutter Crate from the Body

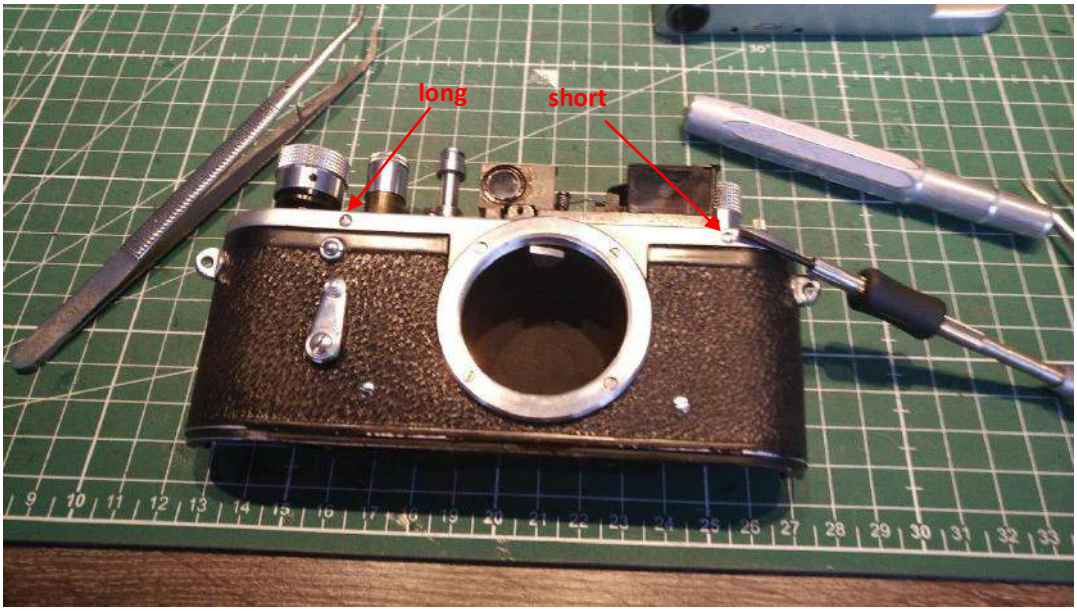
As a final sub-project, the shutter crate needs to be removed from the body.
That will give access to the bottom bearings of the shutter spring rollers and to the restrictor gear. Then, cleaning and lubrication will become easy. We expect to find lint and film debris at this bottom position that needs to be removed. The top bearings of the shutter spring rollers will be lubricated – if at all - without gaining a special access.

We will start by removing the three screws from the top plate in the back, see the figure below. We will use a 1.8mm screwdriver.



Removing the three top plate screws on the back of the Zorki-4.

Next, we will remove the two screws from the top plate on the front, see the figure below. Note that in this picture, the screw on the left side is a long one and the one the right side is a short one. We will remove both screws, using a 1.8mm screwdriver.



Removing the two top plate screws on the front of the Zorki-4.

Next, we will remove the self-timer lever using a 3mm screwdriver, see the figure below.

Removing the self-timer lever.

We will take out this lever together with its light seal, see the figure.

Self-timer lever with light seal taken out.

When this is accomplished, we will take out the lens mount by removing the four screws, using a 1.8mm screwdriver. See the figure below.

Taking out the lens mount.

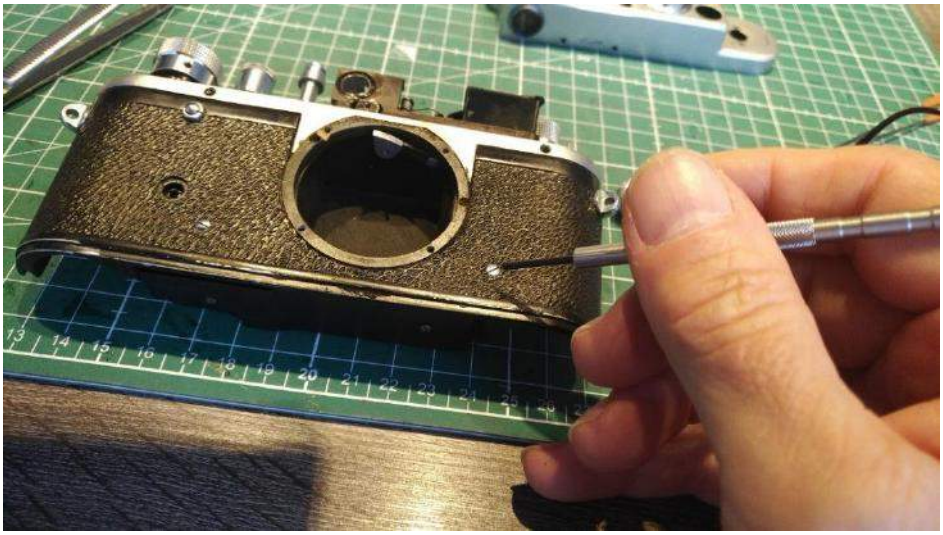
When the four screws are out, we carefully lift out the lens mount, taking care not to lose or mess up the paper shims underneath, see the next figure.

Shims underneath the lens mouth.

To prevent anything happening with the order of the shims it is best to mark the positions. Also mark the lens mount top position, while you are at it. This assures that we can reassemble the mount exactly as we have taken it out.

Marking the shims positions and the top of the lens mount itself.

Finally, we will remove the last two screws on the front of the housing, using a 1.8mm screwdriver.



Removing the two screws from the front of the housing.

Now, we can take the shutter crate out of the body. We have to wriggle the body, applying force on the bottom part, to make it slip out from underneath the top plate, see the figure below.

Wriggle the bottom of the body (1) to slip the top plate off (2).

This may need some force and time. It may well be the first time in half a century that these parts are coming apart. The result is shown below.

Shutter crate removed from the body.

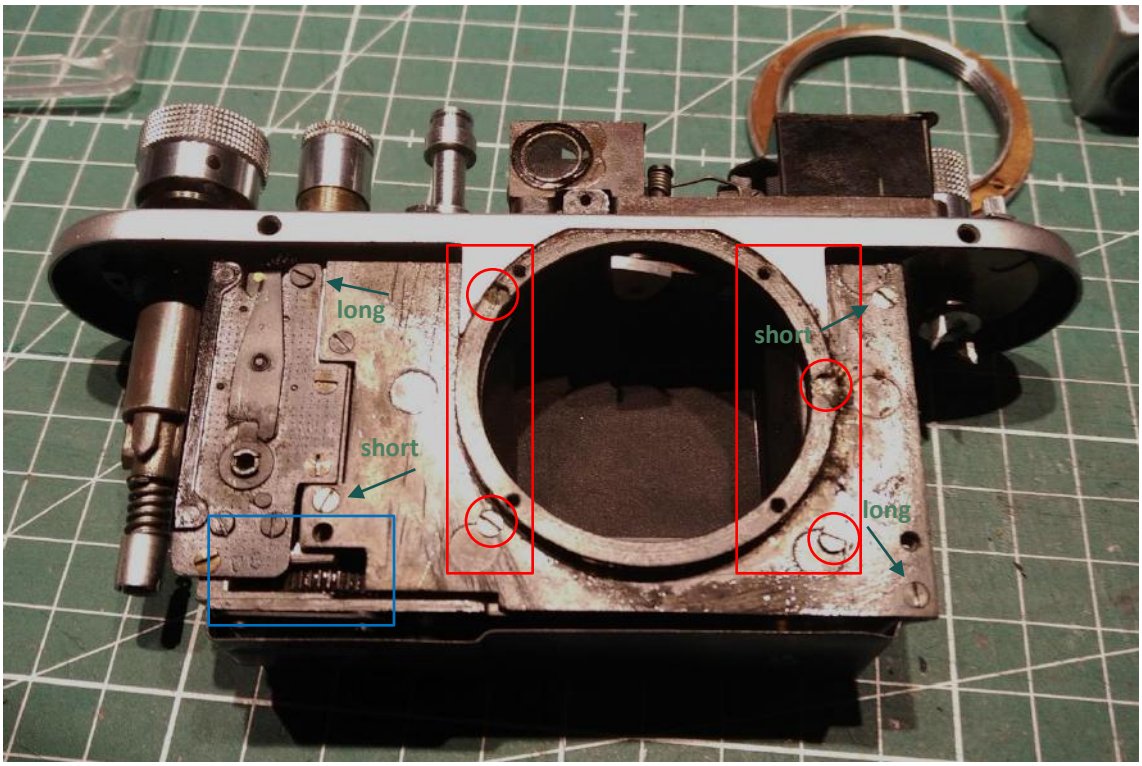
Before we will dive further into the shutter crate, we will first have a closer look at the exterior.
If we look closely at the base for the lens mount, we see the remains of a light seal that has been damaged in the separation of the shutter create and the body.

Remnants of a light seal on the lower part of the lens mount base.

Obviously, this light seal was glued all around the lens mount base. The top part is undisturbed, as can be seen in the above picture. Upon reassembly, we will remove the seal and glue remnants from the lower part. Then we will glue a string of black wool thread around the lower part of the base to replace the damaged seal.

11. Removing the Crate Front and Light Baffles

To get access to the restrictor gears, we will remove the crate front. Before doing that, we will first need to loosen the light baffles inside the crate. The figure below explains.



Shutter crate, showing the restrictor gears in the blue rectangle. The light baffles inside the crate (red rectangles) are held in place with the screws inside the red circles. The crate front is secured by the (long and short) screws indicated by the green arrows.

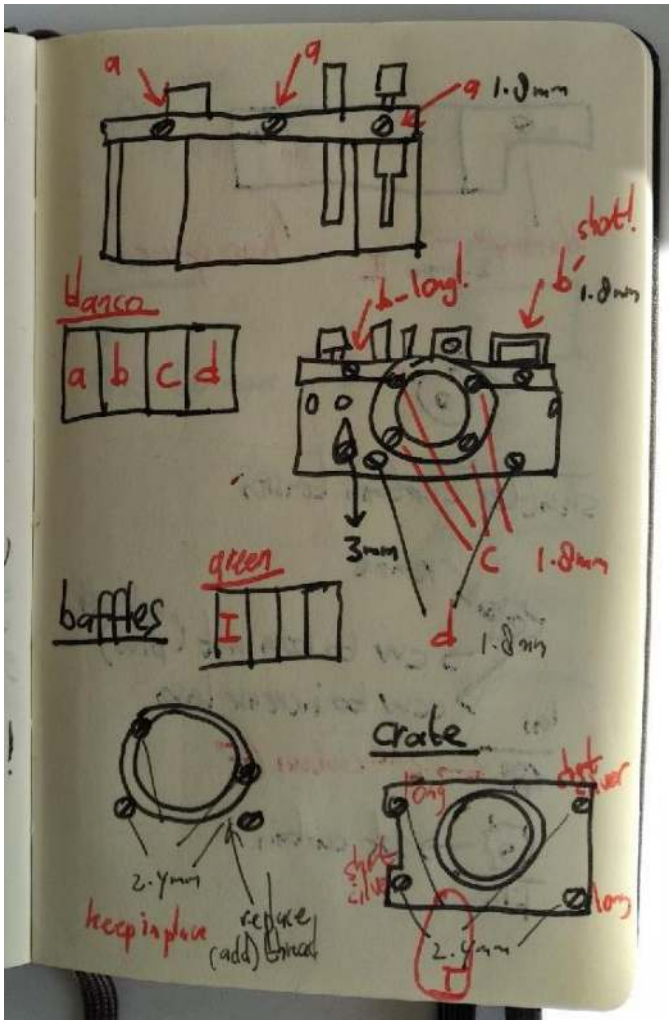
We will start by removing the light baffle screws. The light baffles will fall into the crate from which we will retrieve them after removing the front of the crate. The light baffles

need to be loosened first. Otherwise it will not be possible to remove the front of the shutter crate.

For both the light baffle and the crate front screws we will use a 2.4mm screwdriver.

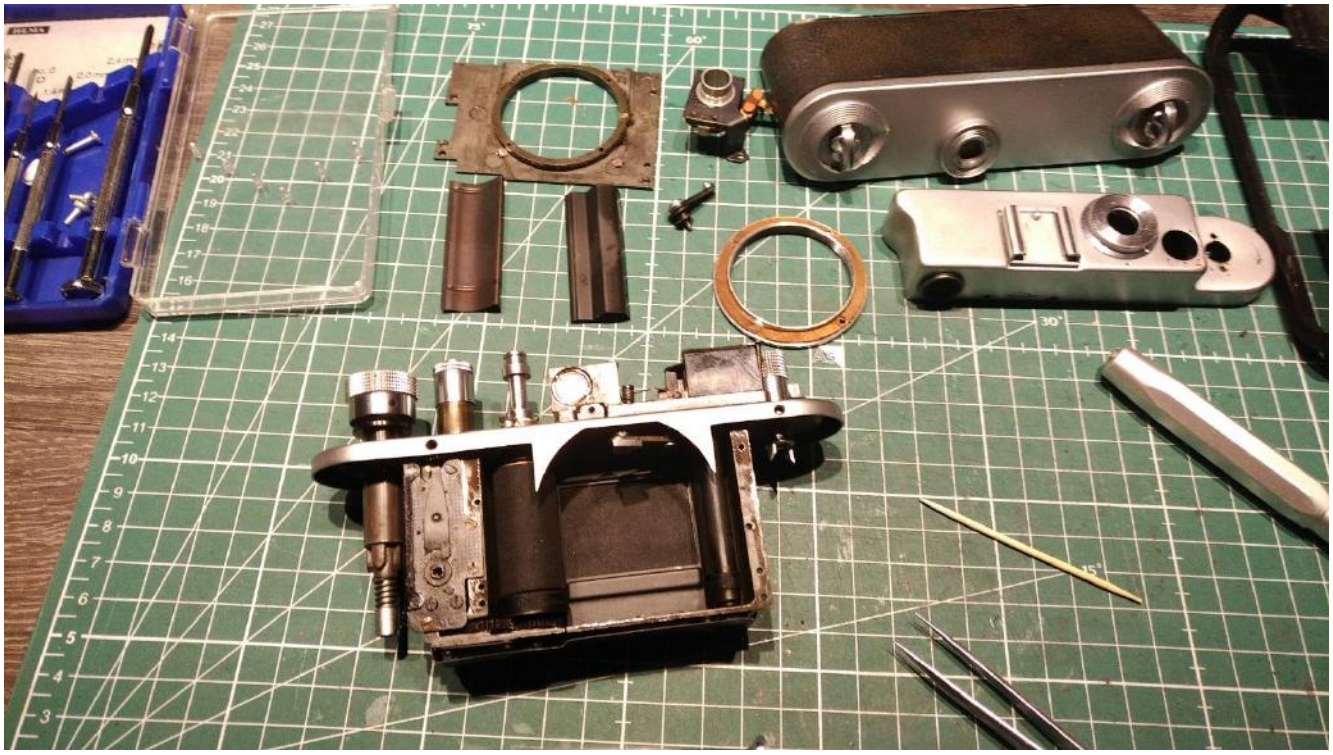
Note that the front of the shutter cate is secured by two types of screw, see the above figure. The ones on the lower left and upper right corner have a shiny head and are shorter than the other two that do not have a shiny head.

Before showing the opened-up shutter crate, this is a good moment again to give an update on the sketches and notes I have taken during disassembly.



My notes on the separation of the shutter crate and the body and the removal of the light baffles and front plate from the shutter crate.

Finally, the opened-up shutter crate is shown in the picture below.



Opened-up shutter crate with above the two light baffles and above that the crate front.

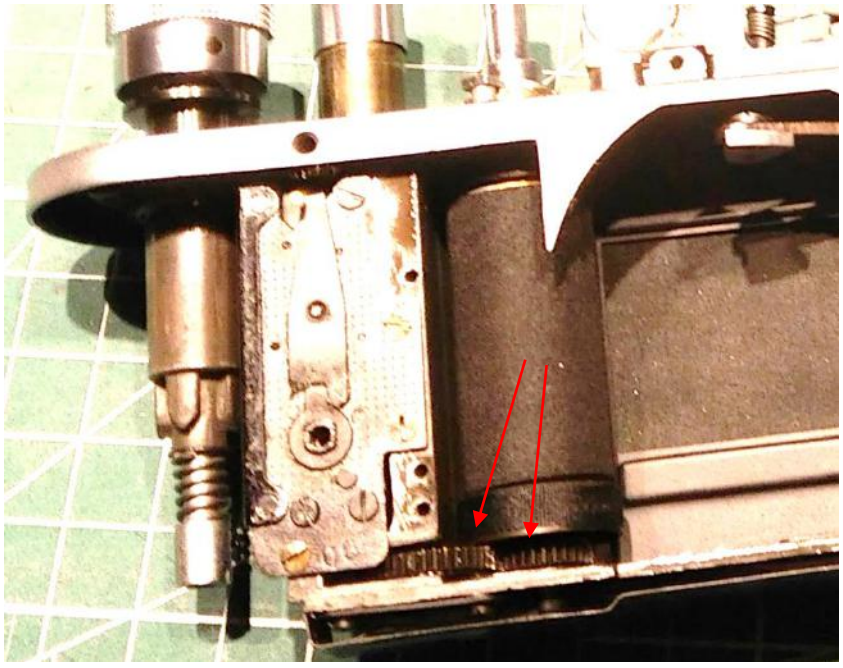
12. A Brief Moment of Despair

If you have come this far in disassembling the Zorki-4, it is perfectly all right to start screaming now. When I reached this point, I had a brief moment of despair and was wondering if I would ever be able to reassemble the camera.

In my despair I googled the web and through ebay ordered a MIR (Zorki-4 without the low speeds) that had been CLA'd by the vendor. Having thus secured a plan B, I set myself to the task of cleaning and lubricating the shutter and film transport mechanism, to be followed by reassembling the Zorki-4. Fortunately, this reassembly – although not without challenges - turned out to be less daunting than I had anticipated.

13. Cleaning and Lubricating the Shutter and Film transport Mechanism

The first thing to do is cleaning the restrictor gears, see the picture below. I was expecting having to take out a lot of lint and film debris, but found nothing of the sort.

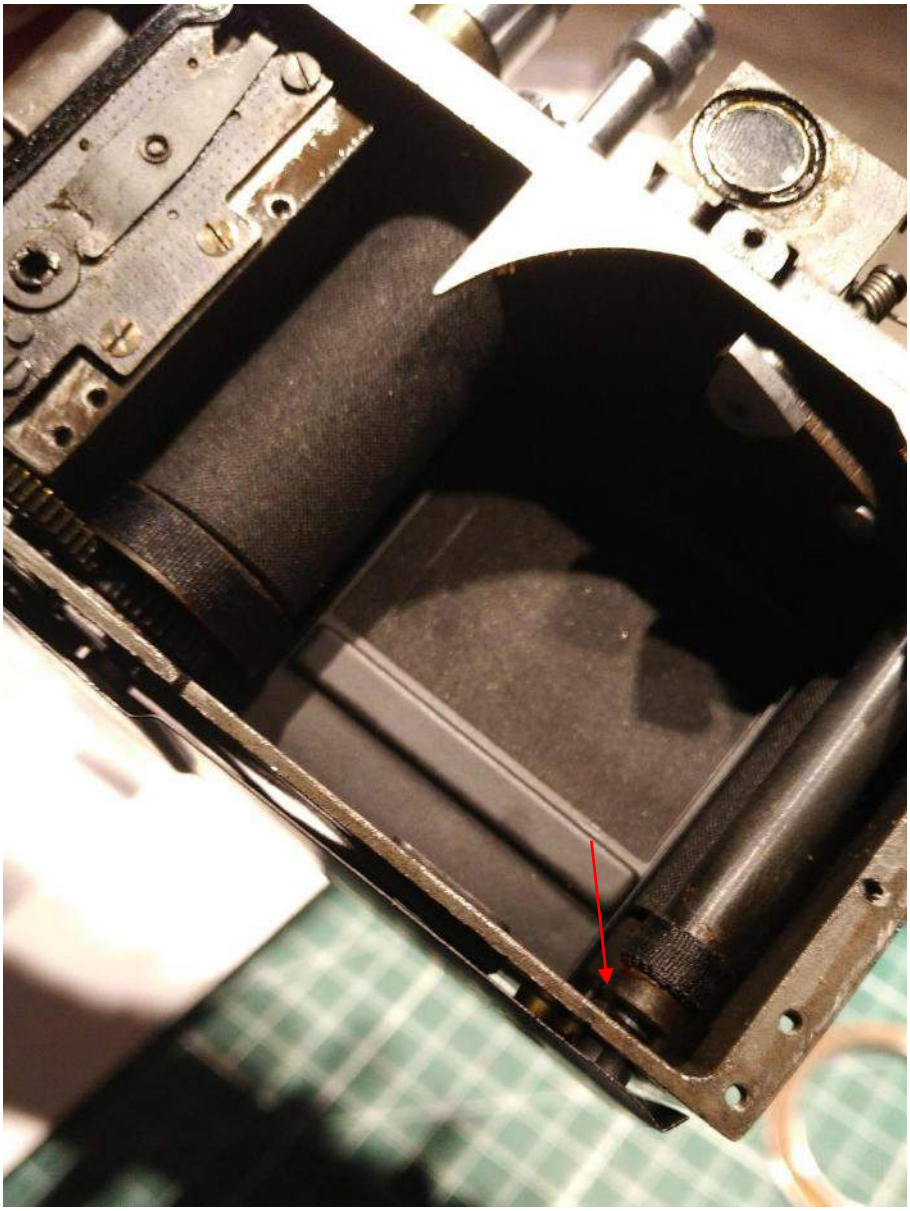


The restrictor gears are indicated by the red arrows. Pieces of film may end up here.

In fact, I found the camera to be very clean. I was only amazed by the amount of short hairs I found during cleaning and lubrication. I guess this may be due to the earlier mentioned supposed off day of the technician assembling the camera, paired to a less than perfect quality control system. My general impression of the camera is that it is a very well thought over design, made of robust elements, meant to last and having maintenance in mind. The only flaw seems to be the lubricants used that tend to harden over time. But who would have thought that these cameras would still be used sixty years after production?

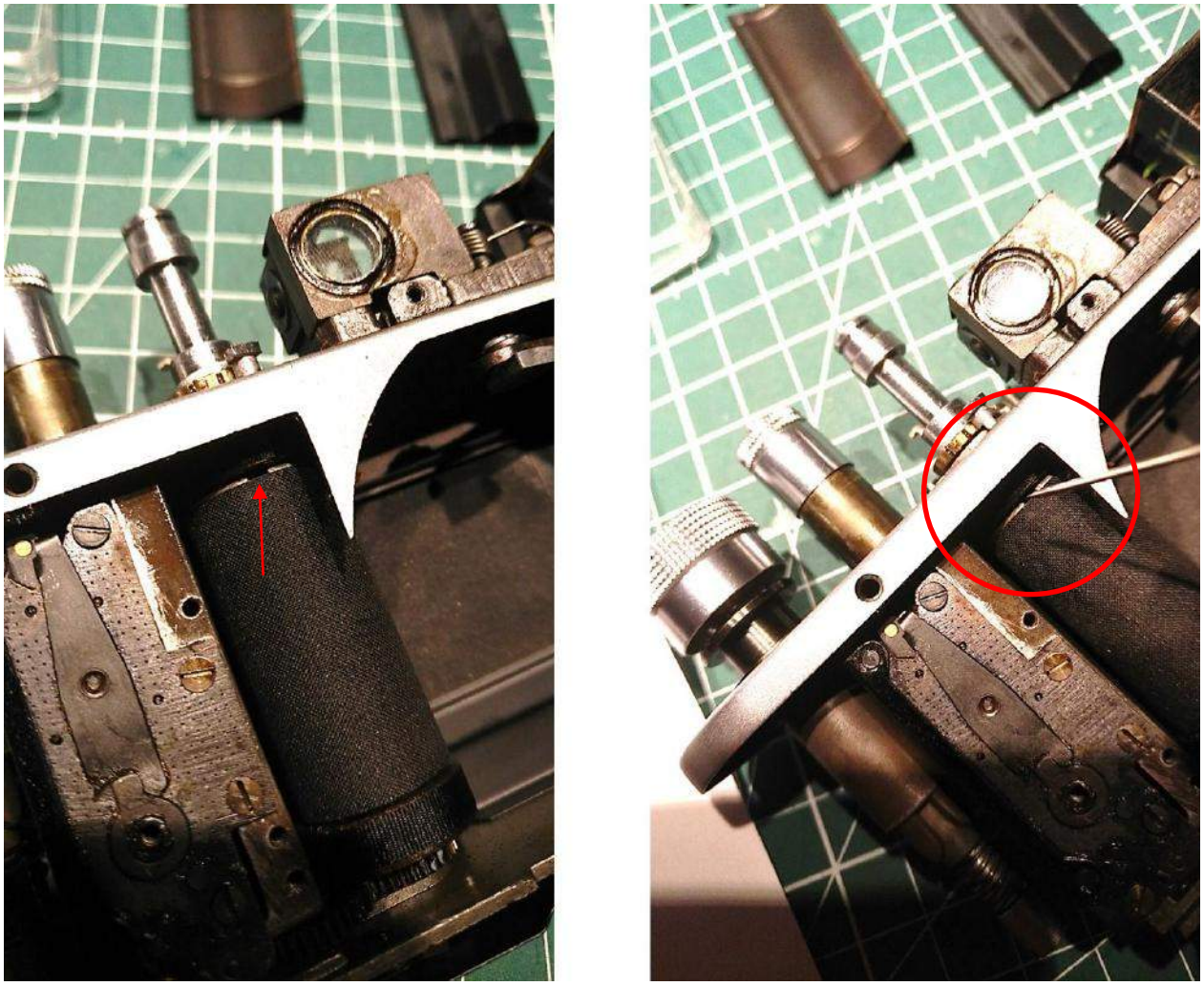
We will lubricate the gears shown in the picture above. By cocking and firing the shutter repeatably we can make the gears turn. That is why we replaced the winding knob earlier. With this process we will get access to all sides of the gears for lubrication. For the lubrication we will be using a silicon grease.

Next, we will lubricate the spring roller with thin (sewing machine) oil. The spring roller is located on the right of the shutter crate, see the figure.



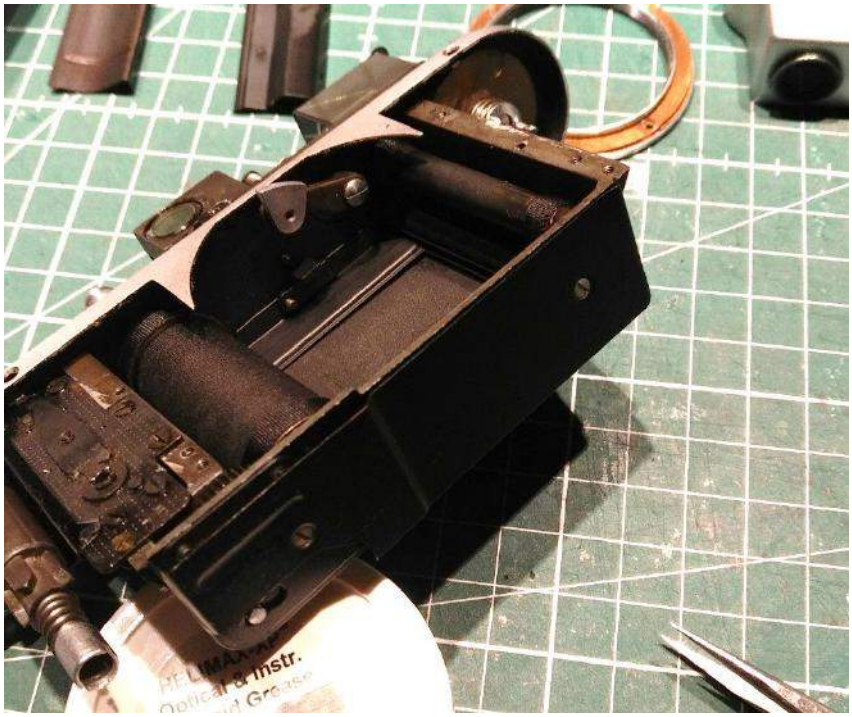
Lubricate the spring roller sparingly on the indicated position (red arrow).

Then, we will oil the shutter drum shaft, taking care that we do not soil the shutter curtain. The point to apply the (thin) oil is shown in the pictures below.

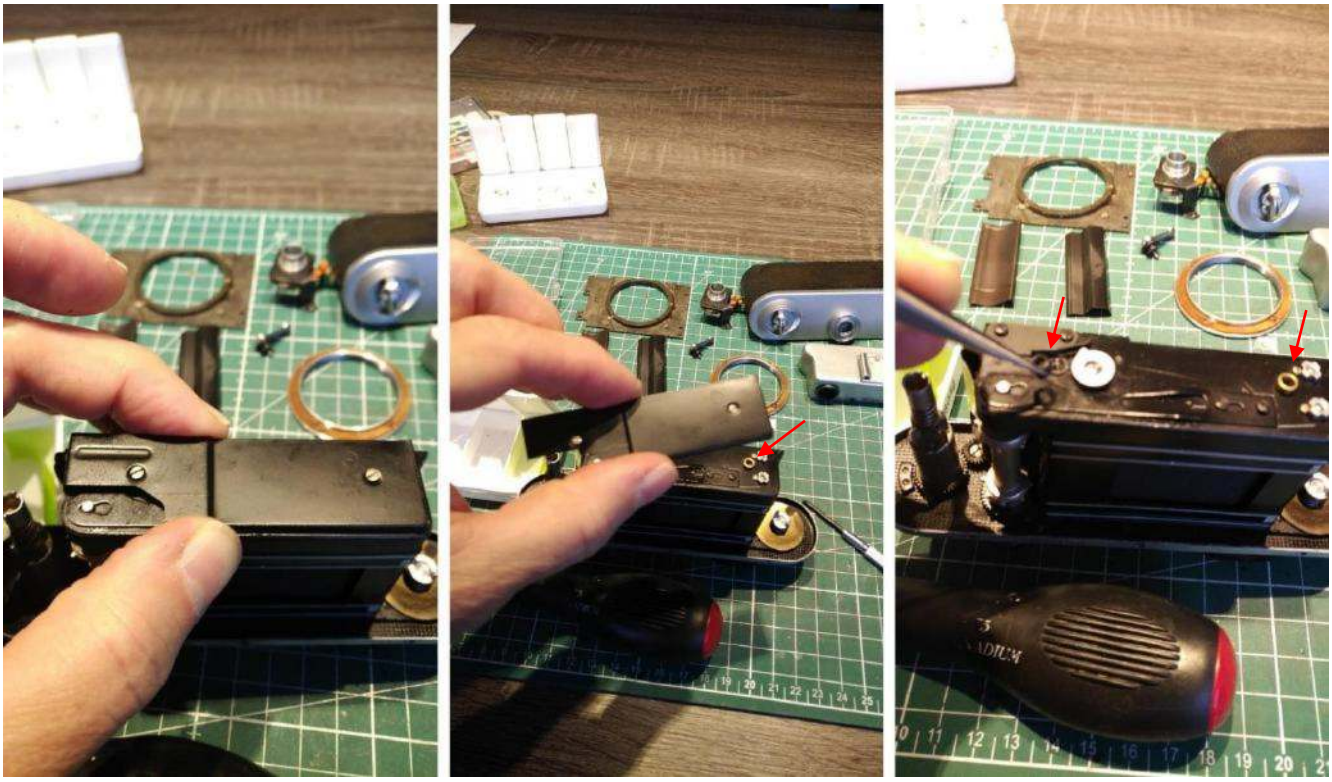


Lubrication of the shutter drum shaft. The red arrow in the left picture shows the tiny access for applying oil. The red circle in the right picture shows how oil is very carefully applied, using a needle.

Finally, we will oil the bottom drum shaft pivot. Therefore, we will have to remove the bottom cover, see the next set of pictures. Both screws in the bottom cover can be removed by using a 2.4mm screwdriver. Note that shims are present under the cover. A black one is used (in my camera) for the screw shown on the left, a brass one for the screw on the right. The shim lengths are not identical, so note which shim belongs to which screw.



The bottom cover is held in place by two screws. Underneath, differently sized shims are being used. Note which one belongs to which screw.



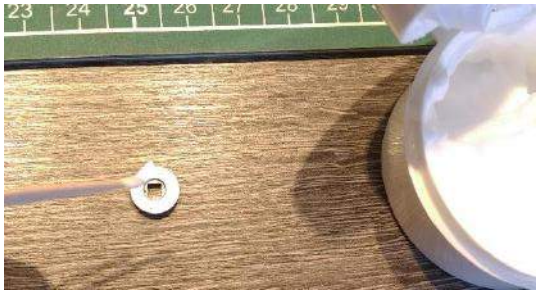
Removing the bottom cover. Notice the brass shim on the right and the black shim (in tweezers) on the left (red arrows).

We will remove the silver-colored shutter latch. Before doing so, note the position. The two screws you can see on the right in the above pictures are for the adjustment of the shutter curtain tension. We will get to that in the end.

The shutter latch can be removed using a 2.4mm screwdriver. When the latch is removed, we will oil the pivot, using sewing machine oil, sparingly applied with a needle, see the pictures below.

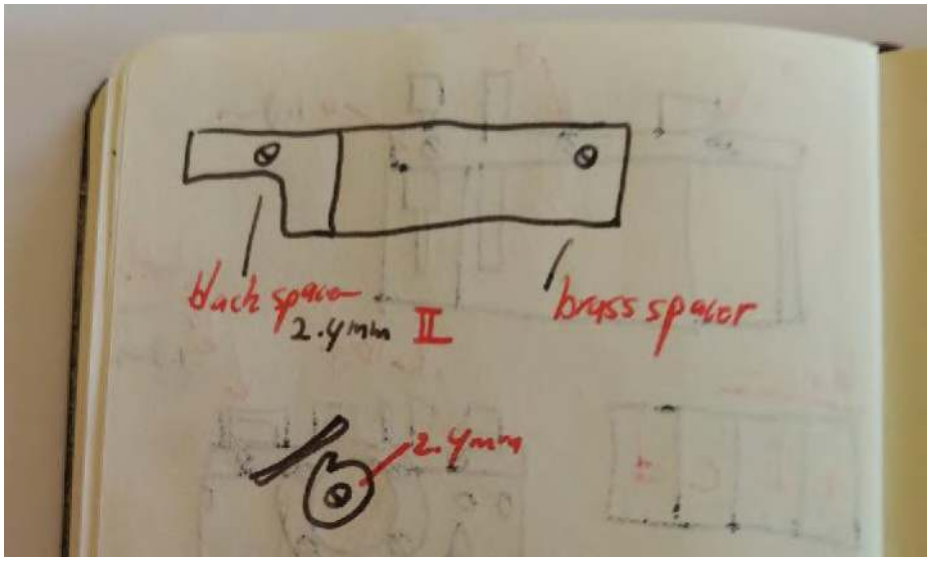
Shutter latch removal and oiling of the bottom drum shaft pivot.

We will lubricate the latch itself with silicone grease.



The shutter latch is lubricated with silicone grease.

The picture below shows the notes I have taken on this part of the disassembly process. Note that the position of the shutter latch has been sketched.



Notes on removing the bottom cover and shutter latch.

Well, this is as far as we will go in dismantling the Zorki-4. We will not dismantle the shutter crate and take out the shutter curtains. There is no reason for it and to quote T. Bert Lance (Director of the *Office of Management and Budget* in Jimmy Carter's 1977 administration) "If it ain't broke, don't fix it".

Now we will have to reassemble the camera. In the process we should not forget to apply a new light seal around the lower part of the lens mount base.
Reassembly is basically disassembly in reversed order, but some steps will need some extra attention. Especially the reassembly of the slow-speed-mechanism is a bit tricky. We will show the whole reassembly process in pictures.
After reassembly we will need to adjust the shutter curtain tension.

14. Reassembly

As said, we will now repeat the whole procedure, but in the reverse order. Some pictures that we will use will look familiar. That is because I did not take enough pictures during the disassembly and 'borrowed' the pictures taken during reassembly.

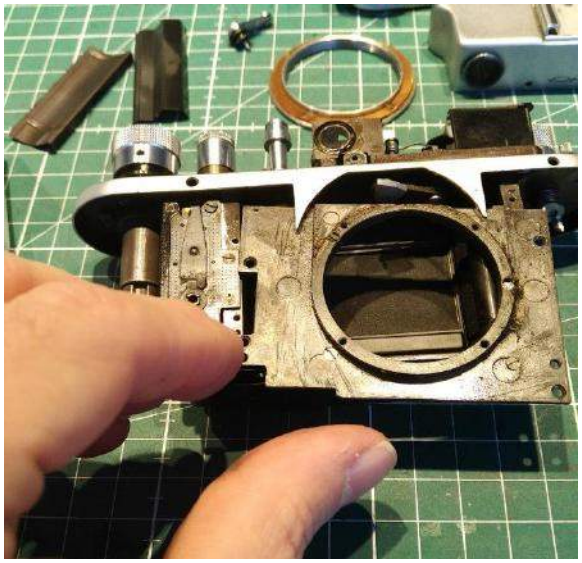
We will start easy and will replace the shutter latch to the original position. After that we will replace the bottom cover, where the two shims will be replaced in their original positions (the black one on the left, the brass one on the right), see the pictures below. All screws can be fastened with a 2.4mm screwdriver. We will tighten the latch really well.

Replace the shutter latch in the original position and tighten well, replace the shims and then replace the bottom cover.

Next, we will replace the front of the shutter cave. Do not make the mistake I made which is forgetting to first put the light baffles into the shutter crate. Once the front is in place, you cannot place the light baffles inside through the lens opening.

Replacing the light baffles. Don't worry too much about the exact placement.

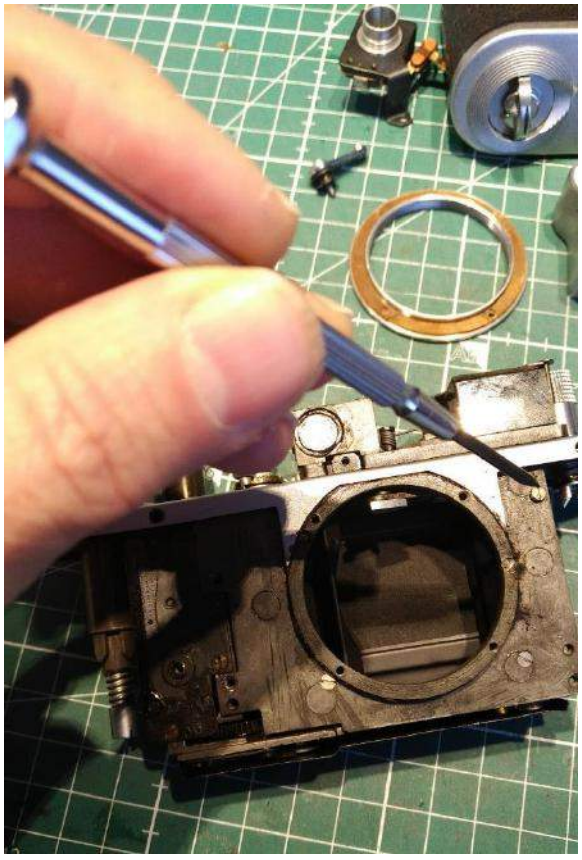
Once the light baffles are more or less into position, we can replace the front of the shutter crate.



Replacement of the shutter crate front.

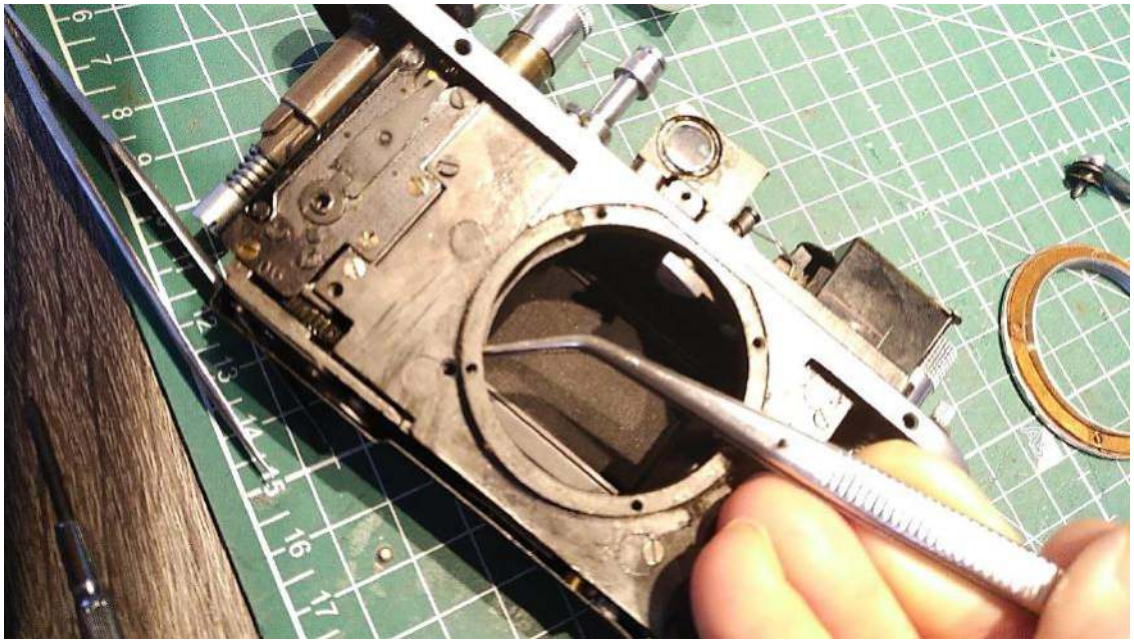
Actually, this last picture was taken when I was clearly forgetting the light baffles. You can also see that I have the screws for the light baffles already in place. At that moment I thought that it would help in aligning and securing the light baffles. I was wrong.

Next, we will secure the front with the long and short screws on the outer rim of the front. We will use a 2.4mm screwdriver for this.



Securing the front of the shutter crate.

The fastening of the light baffles is not very straightforward, unfortunately. Using your fingers to align the screw holes with the screws does not work. Using a cocktail pick instead of the screw also does not work. What does work, fortunately, is using a pair of tweezers to hold the rim of the light baffle and guide it to the correct position to fasten the screw, see the figure below.



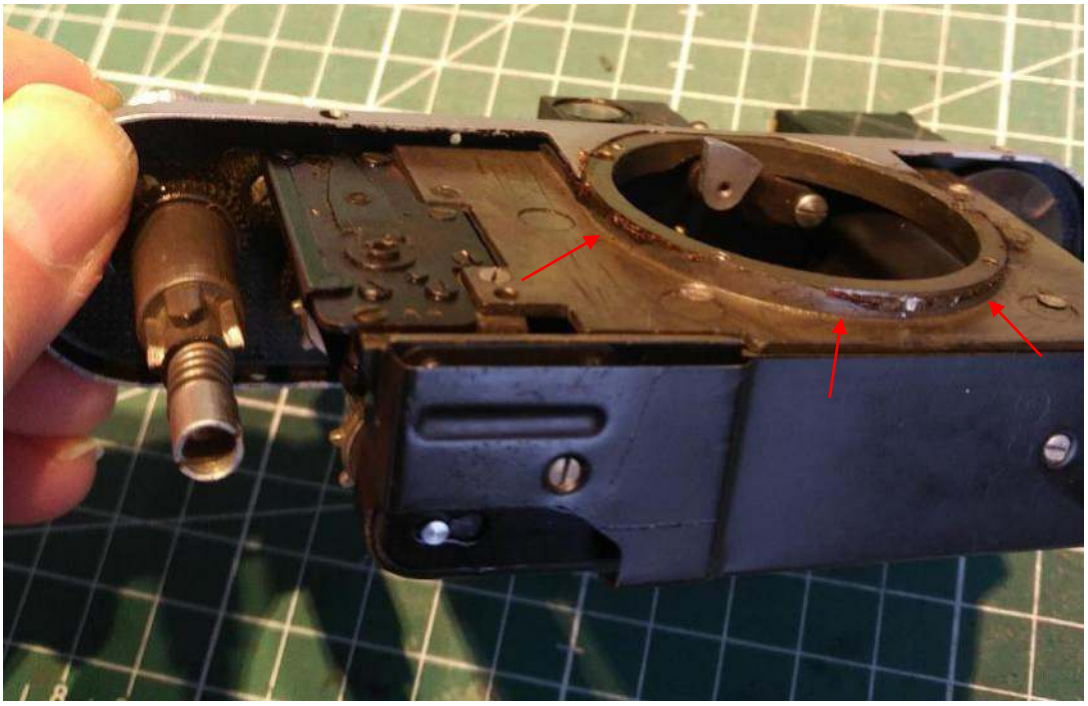
Using a pair of tweezers to align the light baffle for securing the screw.

We will fasten the screw very loosely and when we have all four screws inserted in this way, we will tighten them all (2.4mm screwdriver).

The light baffles secured.

With the shutter crate front and light baffles being reassembled, we will need to replace the light seal around the lower part of the lens mount base.

For that we will first need to remove the remnants of the old seal and glue. Q tips and 70% denatured alcohol and/or lighter fluid and patience will do the job.



Remove the remnants of seal (thread) and glue.

Don’t forget to clean the remnants from the body part as well.

Also clean the seal and glue remnants from the body.

The cleaned lens mount base is shown in the picture below.

Cleaned lens mount base.

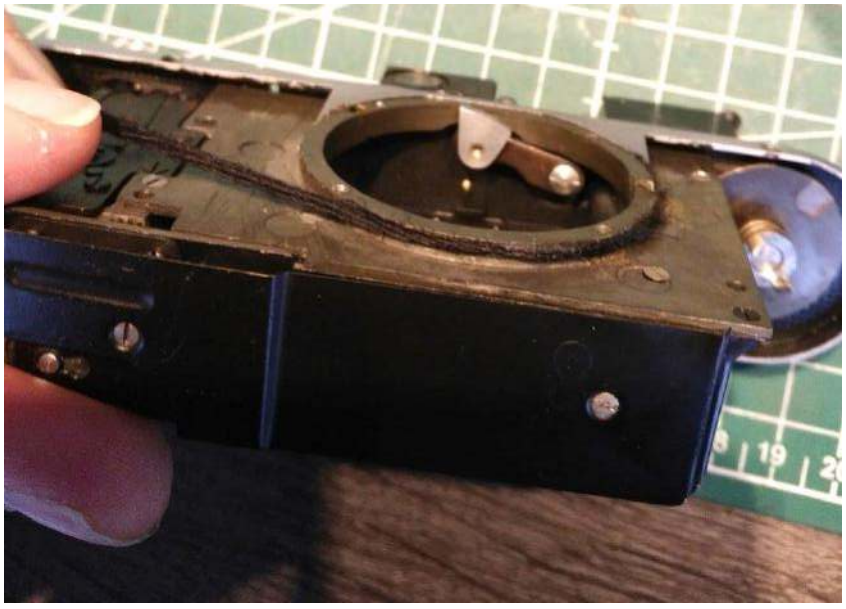
Next, we will prepare a black wool thread for being used as a light seal. This preparation consists of applying a dot of (any) household glue to the tip to prevent it from fraying.

Tip of a black wool thread prepared with glue to prevent fraying.

While the wool is drying, we will apply glue to the rim of the lens mount base. My preferred glue for this (and other) applications is Bison Tix (also because it is developed and manufactured in the town where I was born and raised). When applied to a single surface, the two glued parts can be taken apart relatively easy after drying. When applied to both surfaces, the connection is extremely strong.

Applying glue to the rim of the lens mount base.

Next, we will take the black wool thread and press the glued tip at the beginning of the light seal trajectory. While holding it, we will apply some pressure and twist the thread to the desired thickness before pressing it into the glue. See the picture below.



Getting the light seal into position.

With the light seal in place, we can push the shutter crate into the body. This will be a lot easier than prying the crate from the body.

Shutter crate with new light seal pushed back into the body.

Then, with a 1.8mm screwdriver, we will secure the shutter crate with two screws.

Shutter crate secured to the body.

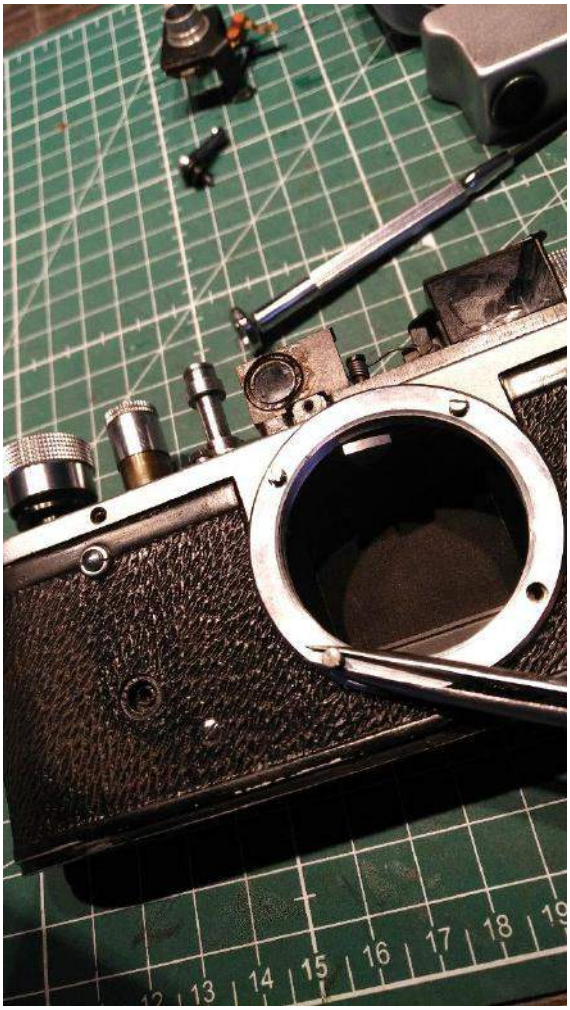
Next, we should refit the lens mount, but a close inspection revealed that the shims were rather loose.

The loose shims (red arrows) need some attention.

If we turn the lens mount around to attach it to the body, we might mess up the order and placement of the shims. Therefore, we have decided to apply some glue first. After the shims have dried, we will turn the lens mount around and put it on the body. Note the mark for the top of the mount.

Attaching glue to keep the shims in place. The red arrow indicates the mark for the top of the lens mount.

We will attach the screws, using a 1.8mm screwdriver. A pair of tweezers may be handy in attaching the screws.



Using a pair of tweezers may aid in attaching the lens mount screws.

Next, we will re-attach the self-timer lever by pushing in the lever with light seal in the hole on the left and securing the screw using a 3mm screwdriver. When that is done, we will secure the top plate to the body with the two front screws (the long one on the left and the short one on the right), using a 1.8mm screwdriver. This is shown in the two pictures below.

These pictures also clearly demonstrate why we have postponed the cleaning of the optical parts, i.e. the rangefinder (left) and the viewfinder (right). It is unavoidable in the assembly and reassembly process thus far to touch the glass with greasy fingers. We will do the cleaning just before we close the top of the camera.

Reattaching the self-timer lever.

Securing the top plate to the body. Use the long screw (green circle) on the left and the short screw (red circle) on the right.

Then, we will turn the camera around and secure the top plate to the body on the back with three screws, using a 1.8mm screwdriver.

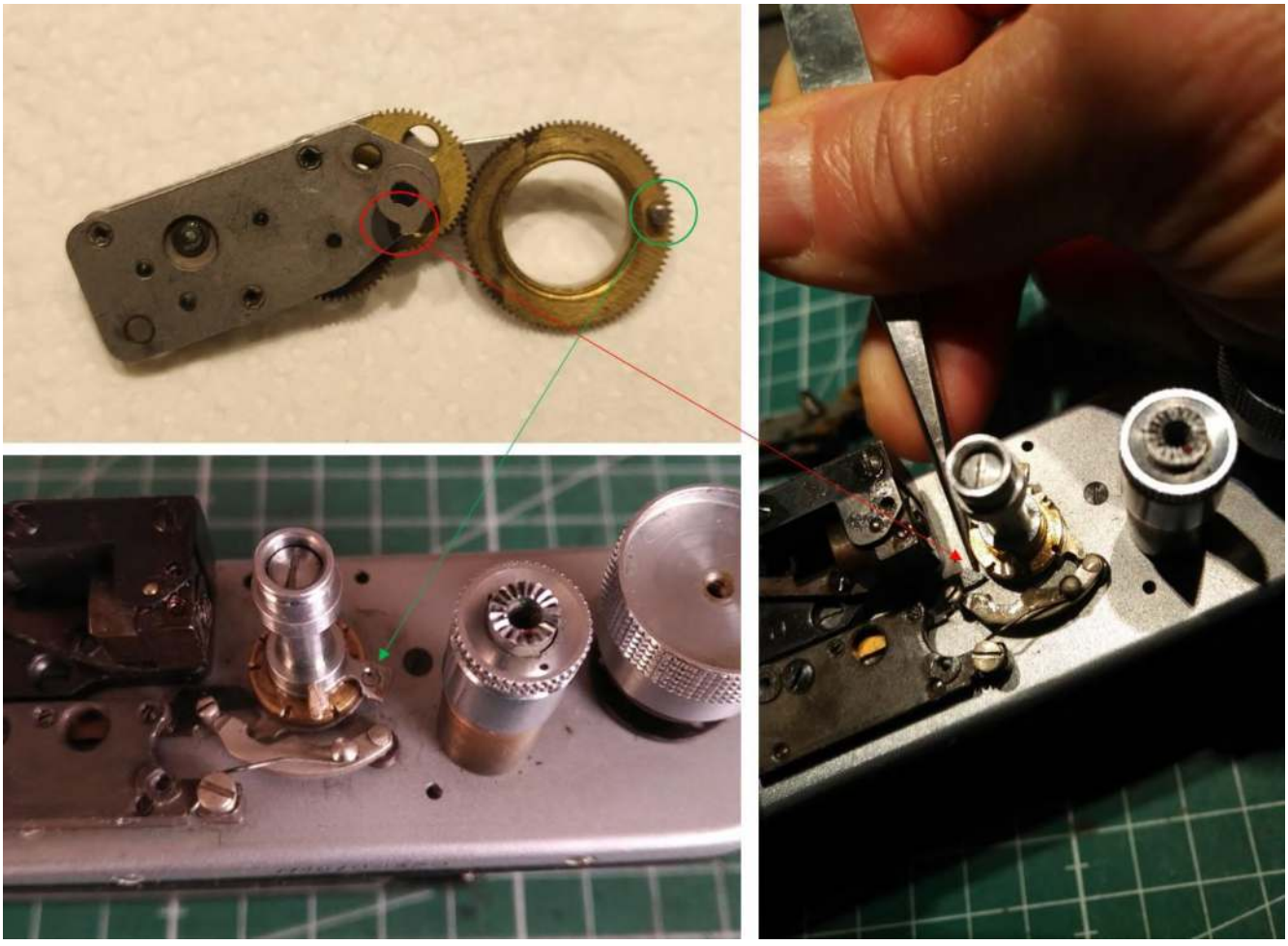
Securing the top plate to the body on the back.

We have now reached the most-tricky part of the reassembly, that is the reattachment of the slow-speed-mechanism.

DAHLE
DAHLE
DAHLE

15. Reassembly of the Slow-Speed-Mechanism

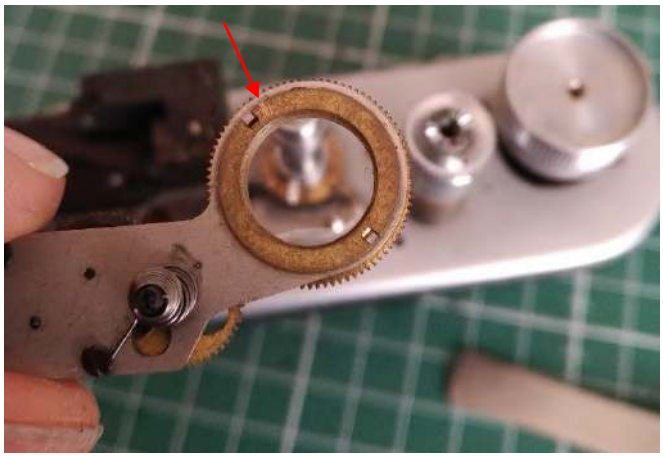
The most-tricky part in the whole reassembly process is the reattachment of the slow-speed-mechanism. We will have to make sure that the (timer) mechanism interacts well with the rest of the shutter mechanism in releasing the second shutter curtain. Therefore, the comma-shaped latch at the underside of the slow-speed-mechanism, see figure below, must activate the black metal lever on the camera body, see figure below, at exactly the right moment.



The comma-shaped latch must activate the black metal lever (red circle and arrow) and the pin on the o-shaped gear should touch the shutter speed selection pin on the indicated position (green circle and arrow).

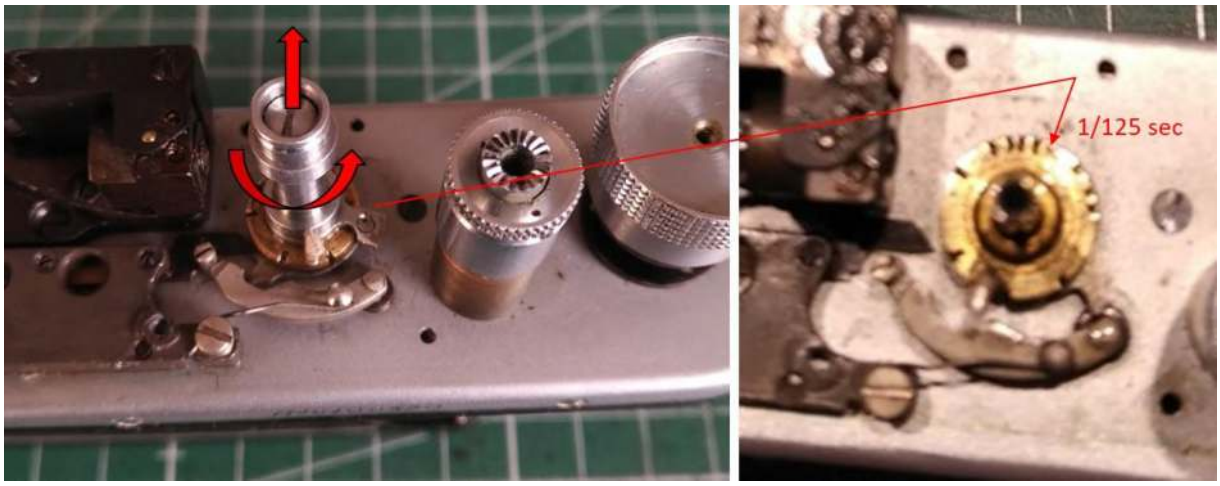
The best way to do this, is as follows:

1. Make a scratch on the top surface of the o-shaped gear to indicate the position of the pin, see the picture.



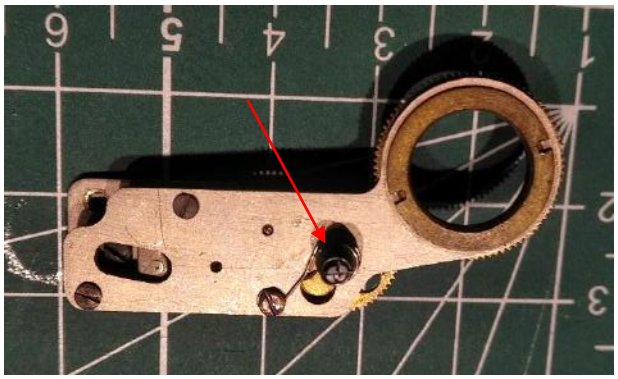
Gently scratch the top of the o-shaped gear to indicate the position of the pin underneath.

2. Cock the shutter (turn the winding knob) and set the shutter speed to 1/125 seconds. That is, lift the selector and make sure that you'll land the pin in the last notch before the slow speed selection notches. These latter notches are shallower than the standard ones. See the figure below.



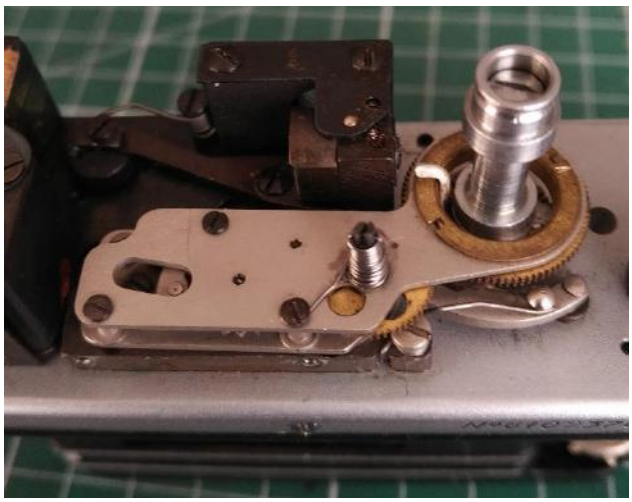
After cocking the shutter: Lift the shutter speed selector, turn it and let the speed selection pin land in the 1/125 sec notch.

3. Cock the shutter halfway, i.e. turn the winding knob until the L-shaped hook is at the top of the brass, notched, shutter speed selector plate (12 o' clock position).
4. Wind the slow-speed-mechanism by turning the o-shaped gear two turns (look at the tensioning of the spring to determine the right direction), see the picture below.



Turn the o-shaped gear two turns and watch the tension on the spring (red arrow) increase to determine the correct turning direction.

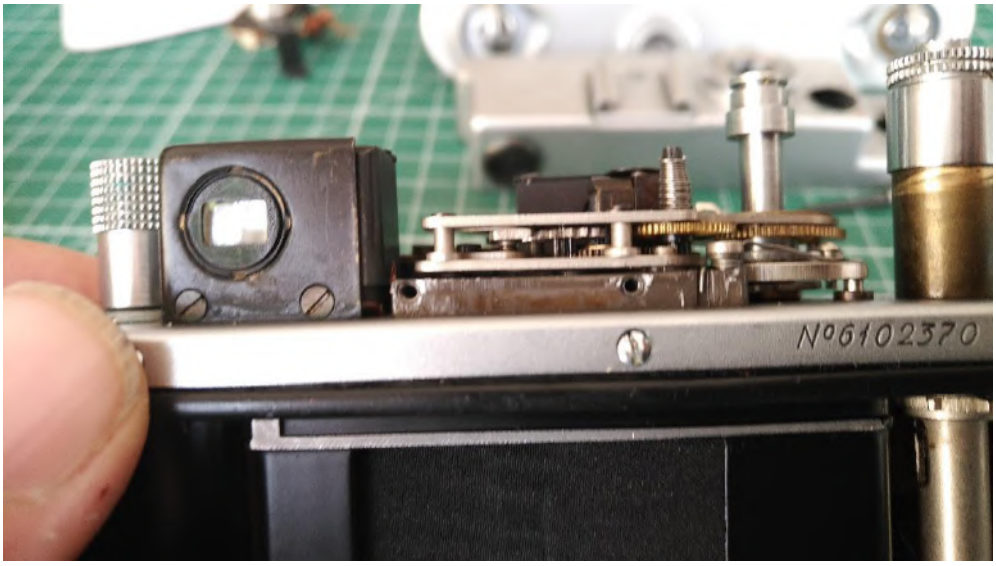
5. Keep hold of the o-shaped gear and replace the shims on the body where the slow-speed-mechanism will land. Now keep holding the o-shaped gear and place the slow-speed-mechanism over the speed selector, wiggling around the L-shaped hook. Keep hold of the o-shaped gear and complete the cocking of the shutter. The L-shaped hook is now positioned to the left.



The setup should now look like this. Contrary to this picture you should keep hold of the o-shaped gear.

6. The pin underneath (look at the scratch mark) should be positioned just before (above in the previous picture) the speed selector pin. The comma-shaped latch is just about to activate the black metal lever.
7. Now, while still holding the gear, replace the two screws, using a 2.4mm screwdriver. You will have to make slight rotation corrections to the o-shaped gear so that the hole in the smaller gear will give access to the screwdriver. Now you can release the tension on the slow-speed-mechanism. The mechanism should unwind for a small amount only. Check that the mechanism is level with the camera body.

Secure the slow-speed-mechanism with two screws.

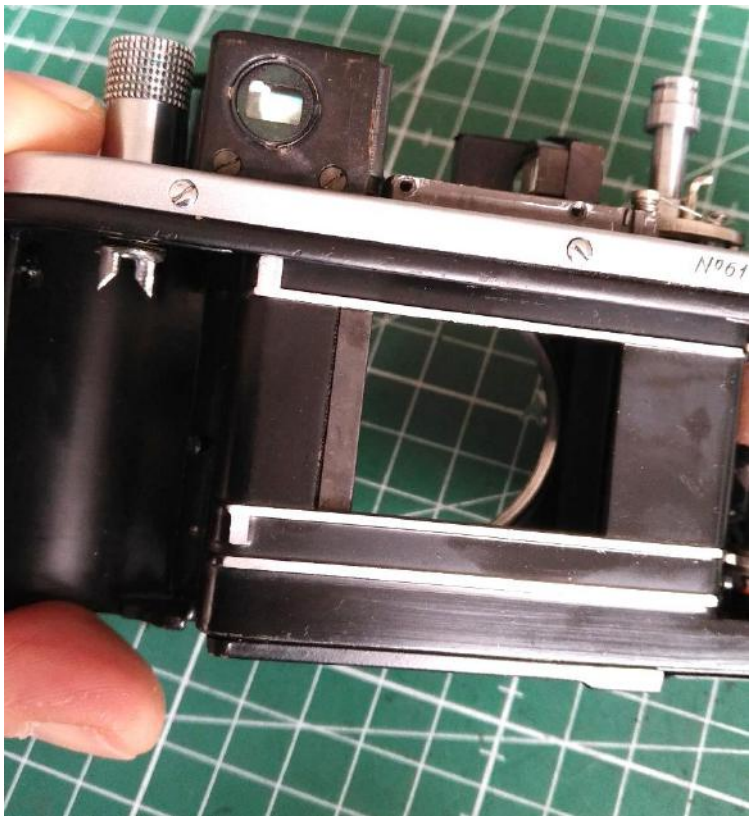


Check that the mechanism is level.

8. Gently, check for the different shutter speeds. If you feel resistance, stop. In that case, or if the shutter speed is not correct, dismantle the slow-speed-mechanism and start all over again. Don't despair. I had to go through the procedure six or seven times before it was correct.

16. Shutter Curtain Tension Adjustment

Already with the slow-speed-mechanism off and everything lubricated I noted that the first shutter curtain did not completely move to a position out of the film plane, see the picture.



The first shutter curtain is not completely moved to the correct position.

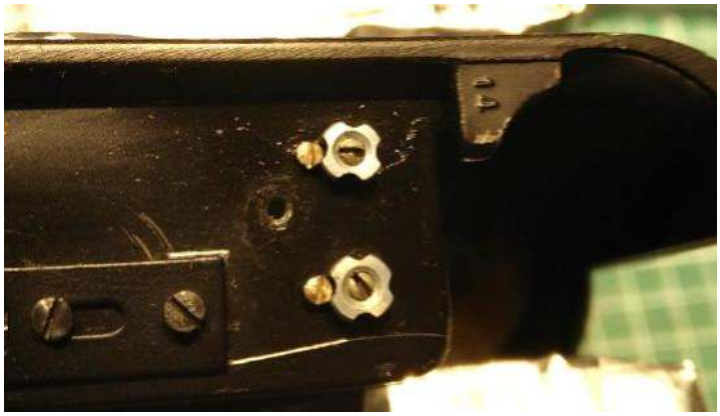
Since everything is cleaned and lubricated, this effect must be due to a lack of tension.

To adjust the curtain-tension we will have to remove the bottom cover of the shutter crate again. Fortunately, we don't have to remove the shutter crate from the body for this, see the next figure.

Camera in upside-down position in a makeshift hold. The bottom cover of the shutter crate needs to be removed. Use a 2.4mm screwdriver and note the positions of the shims.

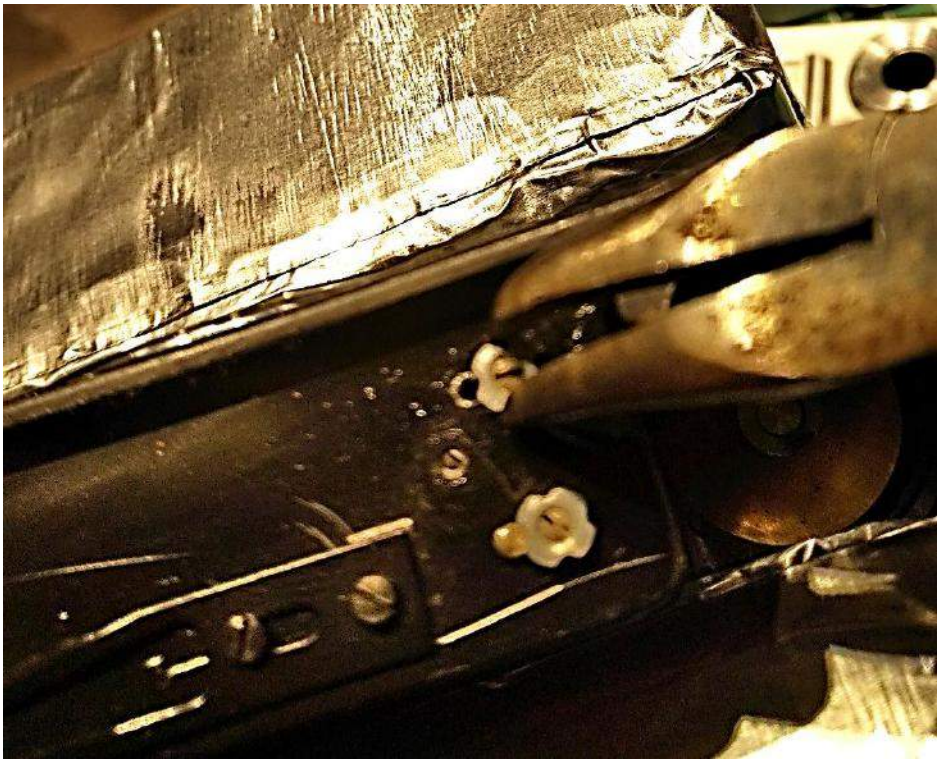
Since we will need to adjust the curtain tension from the bottom of the camera, I have made a support for holding the camera in an upside-down position. This support consists of a block of Styrofoam with a wide slit cut out to hold the camera. To prevent the Styrofoam from shedding particles, I have covered the whole block in aluminum tape. There is no special reason to use aluminum tape, it was just what I was having at hand. The setup then looks like shown in the figure.

Once the bottom cover is removed, we will get access to the shutter curtain tension screws for both curtains, see the next figure.



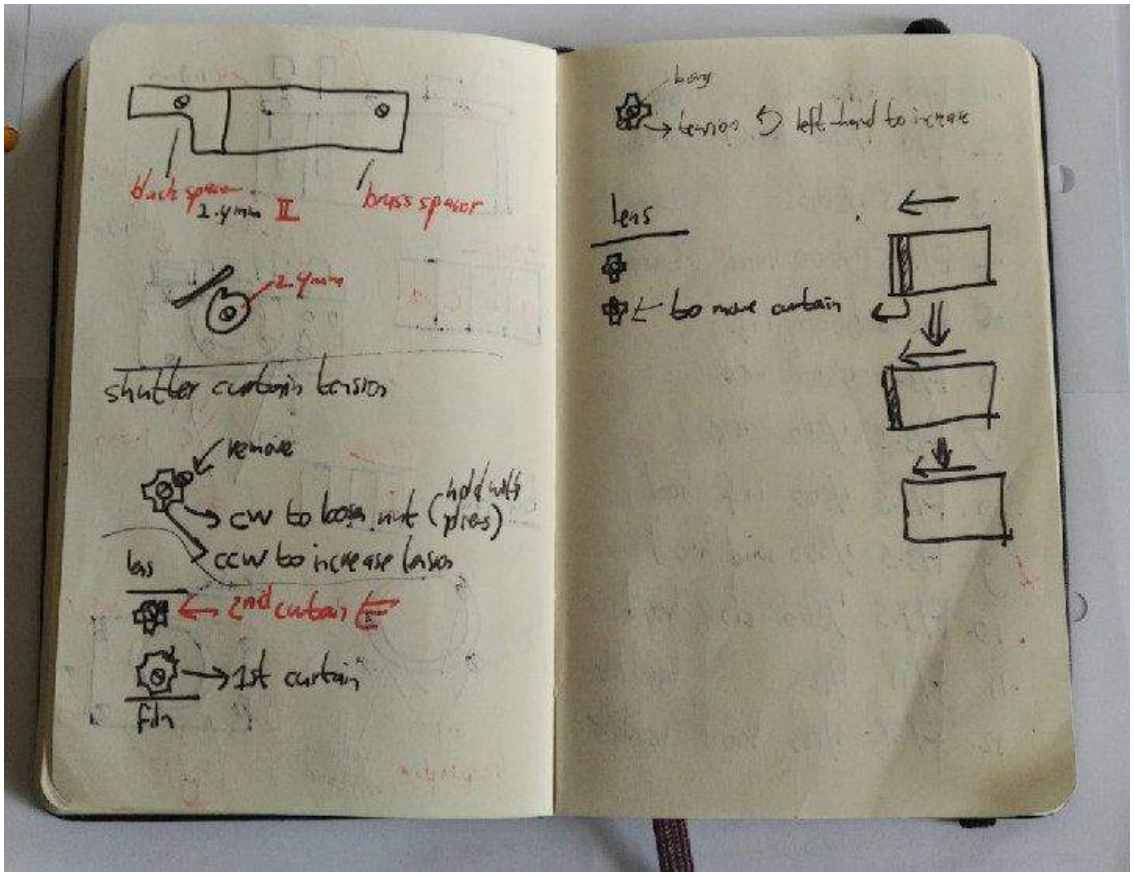
Second curtain (top) and first curtain (bottom) tension adjustments screws.

To adjust (increase) the tension of the first shutter curtain, we will first remove the small stopper. The we will loosen the screw in the center of the adjustment screw while holding this adjustment screw with a pair of pliers. Then we will turn the adjustment screw counter clockwise to increase the tension. We will do this for quarter or half turns, securing the center screw every time, until we see that for a released shutter the curtain end has moved to the correct position. Then we will tighten the center screw and refit the stopper, see the figure.



Adjusting the curtain tension. Shown here is an adjustment of the second curtain tension.

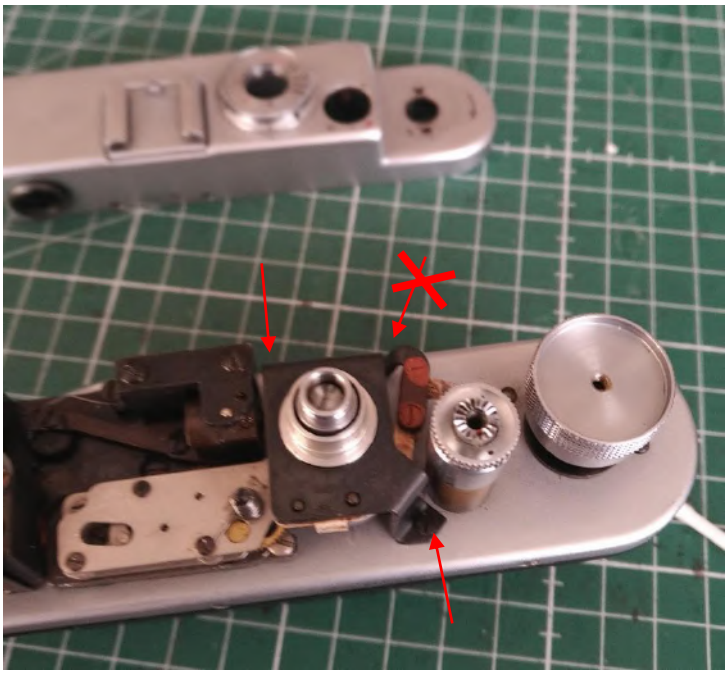
In the picture above, actually the second curtain tension is being adjusted. This was done at a later stage, but I forgot to take pictures of adjusting the first shutter curtain tension. However, the procedure is identical, so the picture is still relevant. My notes on the shutter curtain tension adjustment are shown in the next figure.



Notes on adjusting the shutter curtain tension.

With the shutter curtain tension adjusted, we can now move to cleaning the optics of the rangefinder and the optics of the viewfinder.

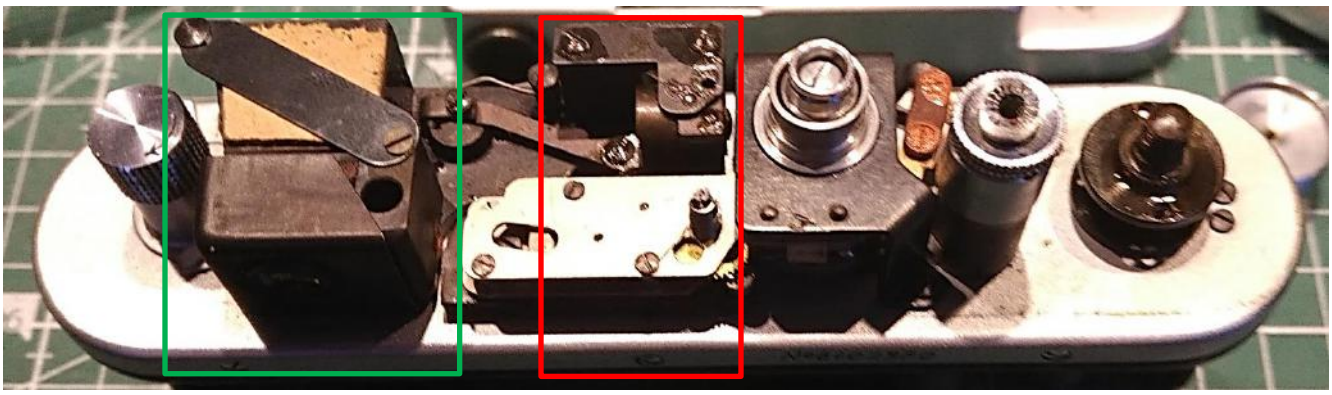
Before doing that, we will first replace the flash synch switch. We will place the device over the shutter speed adjustment shaft and secure it with the two screws. We will use a 2.4mm screwdriver for that and place the screws in the upper-left and lower-right corners only, see the figure.



Securing the flash synch switch with the screws on the designated positions.

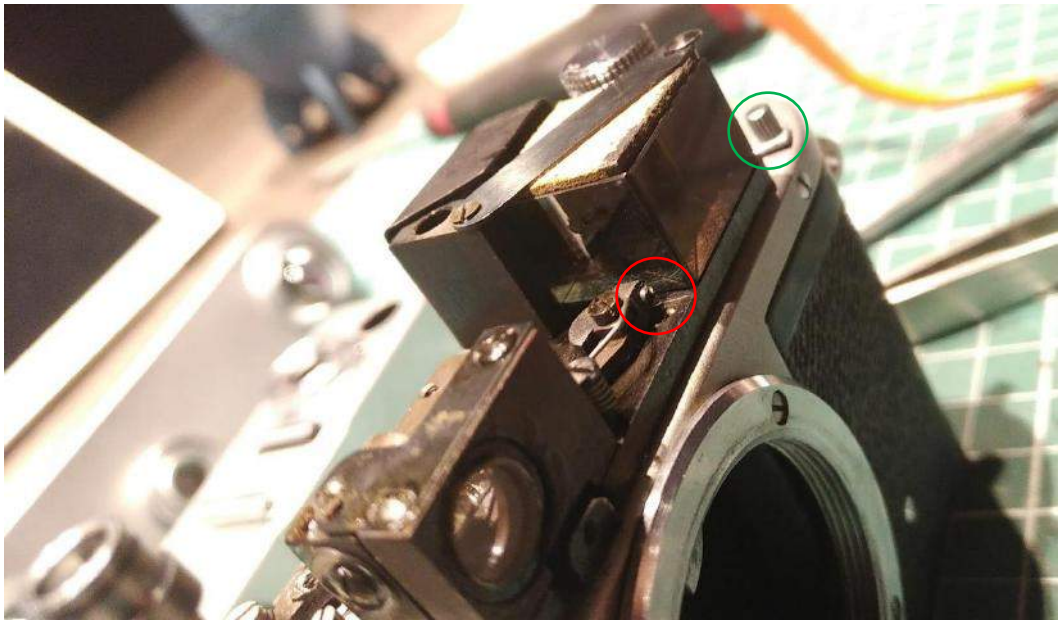
17. Cleaning the Optical System

When looking at the camera with the top removed, we will see the viewfinder on the left (to the right of the rewind knob) and the rangefinder to the right of that.



Viewfinder in the green rectangle and (coupled) rangefinder in the red rectangle.

The view from the front is shown in the next picture.

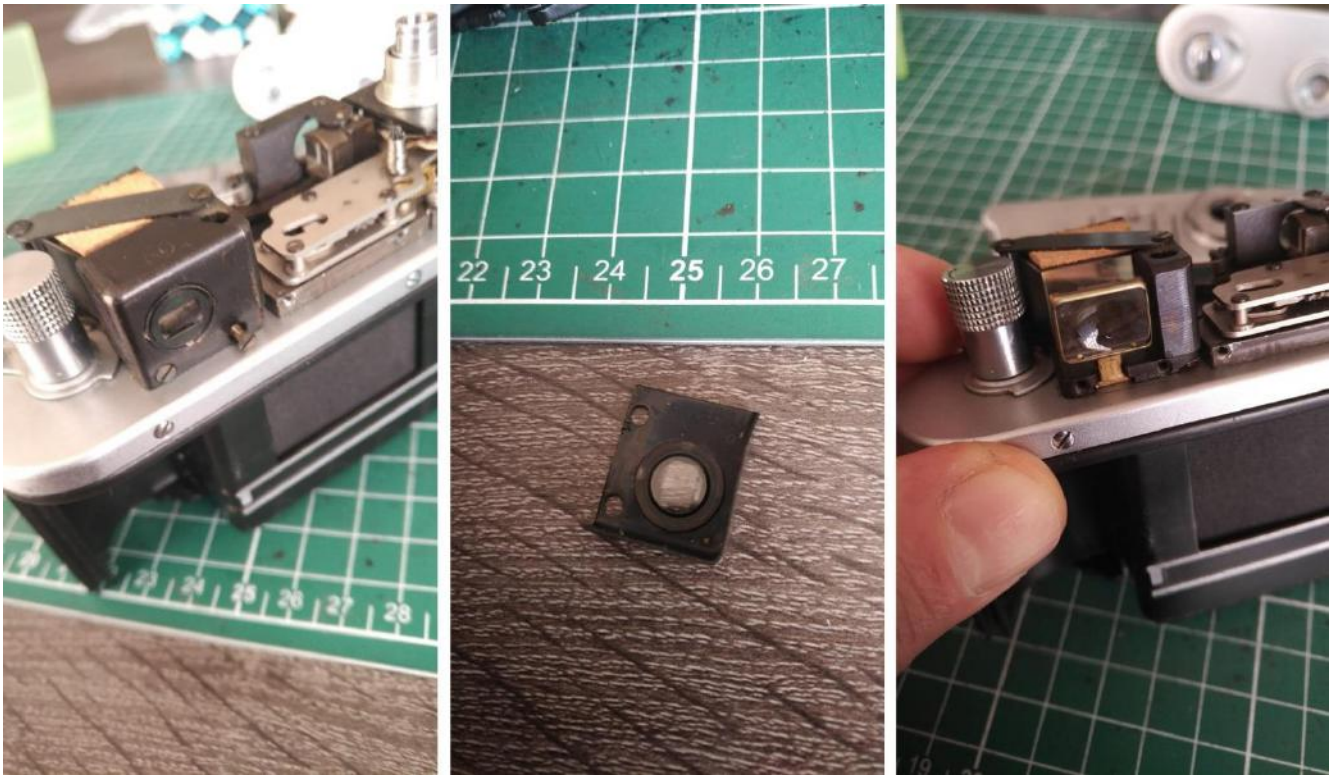


Front view of the camera without top. On the left the rangefinder and on the right the viewfinder. A rangefinder calibration screw is visible in the red circle. In the green circle we see a diopter adjustment lever for the viewfinder

In between the rangefinder and the viewfinder, we will see the coupling mechanism. The rangefinder can be calibrated by turning the screw shown in the red circle in the picture above. When the top of the camera is on, this calibration screw is accessible through removing the screw in the lower left corner of the viewfinder glass, see the figure.

Remove the screw in the red circle to get access to the rangefinder calibration screw.

We can get further access to the viewfinder by taking out the screws on the viewfinder window, see the next figure.



Removing the viewfinder window to get a better access to the viewfinder.

We will blow the dust away and avoid touching any mirroring or colored surface. The other glass surfaces we will clean using q tips with 70% denatured alcohol. Since the mirrors are made of silver deposited on the glass, rubbing or even touching them may result in irrecoverable damage. For the same reason we do not touch the colored spots of the rangefinder optics.
When all other glass is cleaned, we will replace the viewfinder window and will be ready for putting the top back on.

18. Putting the Top Back On

We will start with removing the winding knob. We will do that by turning it counter clockwise. With the winding knob removed, we can place the top over the optical system

and start securing it by securing the two screws above and below the winding shaft, see the figure. We will use a 2.4mm screwdriver for that.

Securing the two screws above and below the rewind shaft.

Next, we will add the rewind knob again, securing it by turning it clockwise.

Securing the rewind knob by turning it clockwise and securing the shutter speed indication ring (see red arrow).

While we are at it we will also secure the screw of the shutter speed indication ring. We will use a 1.2mm screwdriver for that.

Then we will secure the two screws on the back, using a 3mm screwdriver for the one on the left and a 2.4mm screwdriver for the one on the right. These two screws – at least for this copy of the Zorki-4 – are not identical.

Securing the top on the back using two (non-identical) screws.

Next, we will secure the screw on the front, using a 3mm screwdriver and reattach the winder knob top plate, using a 4mm screwdiver.

Securing the last screw. Note that the screw next to the viewfinder window is an access for the rangefinder calibration.

Then, we will give the camera a final polish, reattach the lens and ‘Bob is your uncle’.

Reassembled camera. Don’t forget to take off the cleaning cloth lint from the rewind knob.

19. Checking the Shutter Operation

Now that we have cleaned and lubricated the camera and have performed a minor adjustment of the shutter curtain tension, we want to check the correct flow of the shutter curtains. Instead of running a test film through the camera, we have thought up a way of checking the flow using a digital camera.

The idea is that we will create a lightproof volume. On one side we will place the opened Zorki-4 camera. We will place a sheet of tracing paper on the focal plane. On the other side we will place a digital camera with a macro lens that is focused on the tracing paper.

We will cock the shutter of the Zorki-4 and select a shutter time. Then we will select the Bulb setting on the digital camera (with the appropriate aperture setting and ISO value, this might need some trial and error). We will activate the shutter of the digital camera (press the shutter button and keep it pressed), that is we will open the shutter. Nothing will happen since the shutter of the Zoki-4 is closed.
Then we will fire the shutter of the Zorki-4 and after that we will close the shutter of the digital camera (release the shutter button). Using a cable release for the Zorki-4 might ease the handling of both cameras.

Through examining the image captured by the digital camera we can see if both shutter curtains travel as expected. If one of the curtains is traveling too fast or to slow, we will see that in the image. Through altering the tension of the curtain(s) involved we can correct for that. Once we are happy wit the results, the camera is set for having a roll of film run through.

To make such a setup we will start by making a rig to hold the Zorki-4 camera at one end and provide a means to fasten the digital camera on the other end. For that we will be using a macro-slider and some metal strips, see the picture.

Rig to hold the Zorki-4 camera at one end.

Next, we will make some cushions from strips of rough cotton and broad adhesive tape.

Making cushions to hold the Zorki-4 without scratching it.

We will make it tight enough so that we can squeeze in the Zorki-4 without its cover.

Zorki-4 without cover in the rig.

Next, we will place a piece of tracing paper on the focal plane of the Zorki-4 and add the digital camera, securing it on the tripod screw. Here we are using a Nikon D7200 with

Nikkor 40mm macro (micro in Nikon terminology) lens. We also have attached a (standard) cable release to the shutter of the Zorki-4.

Zorki-4 and Nikon D7200 with Nikkor 40mm macro lens attached to the rig.

Here is another shot of the setup.

The rig shown from another angle. Note the small cushions made to position and tighten the Zorki-4.

Next, we will create the darkened environment. We will do that in two steps. The first step involves the use of black paper and is shown in the next figure.

First step in creating the lightproof volume: adding a paper tunnel between the Zorki-4 focal plane and the take-up lens of the digital camera.

Next, we will wrap this setup in black cloth to make it really lightproof. We will take long-time bulb shots (a few seconds) with the digital camera, not using the Zorki-4 at all, to test for light leaks. When the image taken is completely black, we are good.

Setup wrapped in black cloth to make it lightproof.

Next, we will take pictures for different shutter speeds, inspect the digital images and – if necessary – adjust the curtain tensions. Be warned, this is a tedious process. For a large part, this is due to the shabby testing rig. For this camera it sufficed and we only had to adjust the second curtain once.
If the construction will be further developed it might also be possible to use the digital camera to check for actual shutter speeds. One way might be to start shooting at different digital speeds with the Zorki-4 in Bulb mode. Then shoot the same scene at one speed with the Zorki-4 with the digital camera in Bulb mode. Finally compare the histograms and see which digital speed most closely matches the Zorki-4 speed. Repeat this for all speeds.

Image taken with the Zorki-4 and Nikon D7200 test setup (the image is upside down and left-right reversed of course).

20. Test Shots

Since the proof of the pudding is in the eating, we will not be finished until we have run a film through the CLA'd camera. I have taken out the Zorki-4, loaded with a roll of Kodak Gold 200 (200 ISO), on a sunny and on a foggy winter morning and tested for different aperture and shutter speed combinations. Some of the shots are shown in the next figure.

The results are – technically – good. The shutter shows no lag or capping. The exposures are consistent with the applied 'sunny 16 rule'. Changing the shutter speed in accordance with a changing aperture value does not change the exposure.

Zorki-4 test shots on Kodak Gold 200 after CLA.

21. Conclusion

This project, even if I haven't done anything fancy like replacing the shutter curtains, has been the most involved camera dismantling and reassembly I have ever performed so far. Looking back, I think that the Zorki-4 camera is the best camera for beginners to learn camera CLA and repair. The camera does not need special tools and I have not encountered nasty or fragile clips. A set of standard precision screwdrivers, a pair of needle-tipped pliers and maybe a pair of tweezers will do the job.

Before starting on this project, I have searched the web on information and encountered many horror stories about shutter curtains glued in askew, light leaking through the self-timer and broken pieces. I have even read the advice not to touch a good looking Zorki-4, since most probably it was laid aside because it did not work.

It may have been the particular Zorki-4 at hand, but this copy looks good and it only suffered from gummed up grease. I did find some washers where they weren't supposed to be and I found a lot of hair, but in general my impression is that of a well-assembled camera.

It is well known that for this type of camera you need to cock the shutter before you set the shutter speed. If you don't you will get wrong shutter speeds, but the warning that you might snap off the speed selector pin seems a bit over-dramatic to me. Excessive force is needed to do that and if you handle the device like a precision mechanical tool, which it is, I find it hard to believe that you can brake off the pin by accident.

All in all, I have learned to love this camera. The design is clever and well thought of, although based on copying. The parts are well made and made to fit and last and the camera is extremely maintenance friendly. As a bonus it delivered me a functioning MIR as well. I have also obtained an export Zorki-4 needing CLA. Now I know I can do it.

I think that the Zorki-4 really offers 90% of the Leica experience for 10% of the price. It is absolutely worth investing time and effort to give it a CLA.